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Volume 23 **MARCH, 1940** **No. 3**

CESAREAN SECTION*

A Brief Historical and Technical Review

L. W. BARRY, M.D.

Saint Paul, Minnesota

ACCORDING to Greek mythology, Bacchus[58] was taken from the dead body of his mother, Semele. Æsculapius was born in a similar manner. Among the Romans, Pliny[52] mentions that Scipio Africanus and Manilus were born in this way. Numa Pompilius,[2] the second king of Rome, decreed that no pregnant woman should be buried until the fetus had been extracted by abdominal section. Julius Caesar[70] was supposed to have been born by a cesarean operation, thus its name; but this is unlikely as at thirty he stated his mother Aurelia was still living. The Italian[31] laws also made section obligatory, probably due to the warm support of the Roman Catholic Church. In the middle of the eighteenth century, the king of Sicily issued the death sentence against a physician for failure to perform the operation on a dying mother.

Buddha[21] was supposed to have been delivered from the right flank of his mother. Among the Jews,[44] according to the Mischnejoth written about 140 B. C., the operation was practised on the living mother. Their Talmud describes two types of operation: the "kariyath habbeten" corresponding to our classical cesarean; and the "yozay dofan" or delivery through the flank. The ancient Egyptians[60] depicted the operation in their sculpture.

The earliest account of the operation in any medical work is in the Chirurgis Guidonis[51] de Cauliaco published in the middle of the fourteenth century (1363). The first authentic case of operating on a living woman was in 1491.[51] Nufer[51] operated in 1500. In 1581, Rousset[51] published a work on the subject, reporting a series of fourteen successful cases. That Shakespeare was familiar with the operation is evidenced by his lines in Macbeth where he states that:

> "Macduff was from his mother's womb
> Untimely ripped."

Pickrell[51] states: "Whatever may have been the origin of the word 'cesarean,' the operation was first called 'cesarean section' by the Jesuit, Theophile Raynaud, in his work 'Deortu infantium contra naturam, per sectionem Cæsarem,' 1637."

From Shakespeare's time to 1876 the maternal mortality was fearful. Kayser[55] (Copenhagen, 1844) found a death rate of 62 per cent in eighty years. In 1871, Harris[55] of Philadelphia collected fifty-nine cases with a 48 per cent mortality. In Great Britain[55] only four women out of thirty-eight operated on between 1739 and 1845 survived. In France, Gueniot[55] reported that in Paris only six women survived the operation in the eighteenth century and in the first sixty-nine years of the nineteenth century none survived.

The first authentic cesarean section in the British Isles was performed successfully on Alice O'Neal in 1738 by Mary Donnally,[51] an illiterate midwife. After several attempts to deliver the patient from below, she performed a cesarean with a razor. The incision was to the left of the navel, one inch above and six inches below. She sewed the abdominal wound together with a tailor's needle and common silk, and dressed the wound with a white of an egg. Twenty-three days later the patient was able to walk a mile.

*Thesis read before the Minnesota Academy of Medicine, October 11, 1939.

The first authentic cesarean performed in the United States was done by Dr. Jesse Bennett[8] on his wife in 1794. He removed both of her ovaries at the same time. The first recorded operation was performed by Dr. Richmond in Newton,[57] Ohio, April 23, 1828. The operation was performed in a house with unchinked crevices, without chimney or floor. His only assistants were two women, whose sole duty was to hold blankets to prevent the wind from blowing out the candles. The operation was performed with those few instruments found in a physician's common pocket case. The patient made a rapid recovery and was able to do light housework twenty-four days after the operation.

The first operation of removing the uterus after a cesarean operation was performed in Boston on July 21, 1869, by Professor Horatio Storer.[69]

According to DeLee,[15] Osiander of Goettingen was the first to perform a definitely planned low cervical cesarean section. The latter reasoned that by incising the lower uterine segment, there would be less hemorrhage, that the intestines would not protrude into the wound, and that drainage of the lochia would be directly into the vagina. His first operation was performed in 1805 and his second in 1806. Although both his patients died, he was very proud of his operation and kept one of the bodies to demonstrate the feasibility of the operation to his students. Joerg,[37] in 1806, recommended that the uterus be emptied, suprapubically, by approaching the lower segment of the uterus or the upper portion of the vagina from the side. In 1820, Ritgen[59] attempted to reach the lower segment of the uterus through an incision slightly above and parallel to Poupart's ligament (right), extending from the pubic tubercle to the anterior superior spine of the ilium. The loosely fitting peritoneum was pushed upward until the vagino-uterine junction was reached; this was cut through and delivery was made through the opening. Profuse hemorrhage rewarded his efforts. Baudelocque[3] of Neffe in 1823 carried out two similar operations. One of his patients died of hemorrhage and the other peritonitis. In 1870, Theodore G. Thomas[71] and Skene operated according to Joerg's suggested technic in five cases. Three mothers and four children survived. Dr. Thomas[26] performed his first operation of laparo-elytrotomy, or gastro-elytrotomy in February, 1870, on a young Irish multipara who had died of uremic convulsions eight hours previously. Within a month from the time of this experimental operation he describes his second operation upon a living woman but dying of pneumonia, as follows:

"The patient being placed upon a table, anesthesia was produced to the point of quieting her restlessness and jactitation, with a few inhalations of ether. I then passed my hand up the vagina and dilated the cervix slowly and cautiously, so that at a three-quarter distention no injury was done to its tissue. With a bistoury I then cut through the abdominal muscles, the incision being carried from the spine of the pubis to the anterior superior spinous process of the ilium. The lips of the wound were then separated, and by two fingers the peritoneum was lifted with great readiness, so that the vagino-uterine junction was reached. The vagina was then lifted by a steel sound passed within it, and cut, and the opening thus made was enlarged by the fingers. The cervix was then lifted into the right iliac fossa by the blunt hook, while the fundus was depressed in an opposite direction. I then passed my right hand into the iliac fossa and introduced two fingers into the uterus, while the left hand, placed on the outer surface of the uterus, depressed the pelvic extremity of the fetal ovoid. The knee was readily seized, and delivery easily and rapidly accomplished. The child was born alive, but was a badly developed harelipped and, as I before stated, premature infant. It lived for an hour or two, during which time the rite of baptism was administered to it. The mother, the wound in whose abdomen was closed by interrupted suture, died about the same time as the child."

Thomas[31] operated twice; Skene four times; Charles Jewett of Brooklyn twice; Hime, Edis, Dandridge and Taylor of Cincinnati, and Walter R. Gillette of New York, each once; in all, twelve. Women saved, six; children living but not moribund, seven; bladder lacerated in six cases. In properly calculating the risks of the operation it is fair to exclude the moribund case of Thomas, the intemperate and bedridden one of Hime, and the diseased subject of Edis, who survived, respectively, one hour, two hours, and forty hours. The balance, nine cases, were favorable in four instances and unfavorable in five; six of the nine women recovered, and five children were saved.

Solms[66] and Dührssen,[21] to circumvent manual dilatation of the cervix, combined vaginal hysterotomy with the flank incision of Ritgen. Dührssen designated it as the "Buddha Geburt" or laparo-colpohysterotomy. This operation has gained no recognition.

Davis,[14] in 1924, reported twenty-eight cases

done by a modified gastro-elytrotomy technic with two deaths. He made no attempt to open the vagina. (Although at times it was opened where more room was needed.) The bladder was pushed off the lower uterine segment downward and to the left. The denuded area was incised vertically and the child delivered by internal podalic version. He encountered much bleeding in the abdominal wall, and in several of the early cases the uterine wound tore across the right uterine artery. The operation is time-consuming (fifty minutes to two hours), and presents too many technical difficulties which can be easily avoided by a midline incision.

In 1876 Porro[53] introduced and recommended the supravaginal removal of the uterus with fixation of the cervical stump extraperitoneally into the abdominal wall. This operation was certainly a life-saving measure in infected cases and would have been employed with increasing frequency but for the introduction by Sänger[62] of his rehabilitated classical cesarean in 1882. Sänger's operation enforced rigid asepsis and firm suture of the walls of the uterus, special attention being paid to exact union of the uterine peritoneum as an added barrier to the later leakage of the lochia. Although Kehrer,[38] employing a transverse incision of the uterus and suggesting the same improvements in technic as Sänger, antedated him by one year, he is rarely given any credit for an excellent piece of work. Kehrer may be called the father of transverse incision of the uterus.

With the employment of Sänger's technic the mortality following cesarean section fell rather rapidly from 65 to 5 per cent and lower. Previous to this the uterus had been dropped back into the peritoneal cavity, poorly sutured or at times not sutured at all, dooming the patient to succumb from immediate hemorrhage, or later, to peritonitis.

Although the Sänger operation was a great advance in the right direction because of its simplicity, its control of hemorrhage and intraperitoneal leakage, the maternal mortality was very little reduced in the potentially infected or neglected cases. These poor results induced Fritz Frank,[24] in 1906, to introduce his suprasymphyseal delivery. He made a transverse incision (Bardenheuer) immediately above the symphysis pubis through the entire thickness of the abdominal wall, and sutured the visceral peritoneum of the uterus to the parietal peritoneum. The child was delivered through a transverse incision in the uterus. He carried out thirteen such operations with no maternal mortality. Physick[50] of Philadelphia, in 1822, had recommended a similar operation but had never used it on any subject. Physick thought that the peritoneum could be pushed off the bladder and the anterior wall of the uterus, thus giving space for the delivery of the child without invasion of the peritoneal cavity. Frank found this possible only in part of his cases. Frank's work stimulated Sellheim to extensive anatomic studies of the pelvic viscera in both the pregnant and non-pregnant woman. Sellheim[65] discovered that the peritoneum was very firmly attached to the bladder at its summit and that this attachment was less firm the farther from the center of the bladder one went laterally. In doing the low cervical operation, Sellheim found it very difficult to go over the top of the bladder sub-peritoneally. He adopted a second plan which was similar to Frank's method of splitting both the parietal and visceral peritoneum transversely, suturing them together with a continuous catgut suture before delivering the child by a transverse incision in the uterus. Sellheim developed a third operation in frankly infected cases which he designated as the utero-abdominal fistula operation. He sutured both the parietal and visceral peritoneum to the skin of the abdominal incision, and after delivery of the child brought the gaping ring of the cervix up and sutured it to the sides of the abdominal incision. In 1910, Sellheim, by further experimenting with the low cesarean, simplified the operation by opening the abdomen longitudinally instead of by a Pfannenstiel incision. Instead of suturing the parietal to the visceral peritoneum, he trusted to laparotomy pads to take care of the peritoneal spill. He incised the vesico-uterine plica transversely, dissected the upper flap up and the lower flap consisting of the bladder downward, made a longitudinal incision in the cervix and delivered the child. This fourth (intraperitoneal) operation of Sellheim is the basis for the low cervical or laparotrachelotomy of DeLee, Franz, Opitz, Krönig, and Beck.

Veit[77] and Fromme,[25] in 1908, developed the transperitoneal extraperitoneal operation. At first they used Frank's method but before uniting the peritoneum they took out the original sutures which joined the parietal to the visceral perito-

neum and closed the peritoneum in accordance with its original anatomical relationship. They later changed the operation by making the incision longitudinal in both the abdominal wall and in the uterus. Clamps instead of sutures were used to unite the uterine to the parietal peritoneum. Hirst[32] of Philadelphia, in 1913, independently invented a similar operation. The sutured four layers of peritoneum were brought together in the midline under the fascia of the anterior abdominal wall. Hofmeier,[34] in 1908, introduced a similar operation, differing from the above only in that he recommended drainage of the wound.

There were a certain number of operators, however, who were fearful of the infection of the peritoneum by the uterine spill. Sellheim probably was the greatest exeprimenter along the extraperitoneal lines. Küstner,[41] Latzko[43] and Döderlein[20] almost simultaneously and independently of one another worked out three ingenious approaches to the lower uterine segment, all of them utilizing the space beneath the bladder, or, perhaps, we had better say the space beneath half the bladder, as the site of the incision in the lower uterine segment through which the child could be extracted.

Newell[46] favors Küstner's technic. The latter reports 112 cases with only two maternal deaths. He claims that one-half of the cases were potentially infected and unsuited for the classical operation. Newell's description of the operation is as follows:

"The patient (who should be well advanced in labor) is etherized and the abdomen prepared. She is then placed on the operating table in the Trendelenburg position. Unless the bladder is distended with urine, 150 cubic centimeters of sterile salt solution or boric acid are introduced into the bladder. A vertical incision is made just outside the outer border of the left rectus muscle, extending 12 centimeters upward from Poupart's ligament. The deep layer of fascia is incised with care, the object being to expose, but not open the peritoneum. The reflexion of the peritoneum from the abdominal wall to the viscera and the left side of the bladder is now visible. By means of scissors and gauze dissection the left side of the bladder is dissected off from the anterior surface of the lower uterine segment and drawn well beyond the midline by a retractor. The peritoneal reflexion is pushed upward as far as possible and the anterior surface of the lower uterine segment is exposed by retractors. An incision is made in the midline and the child is extracted by forceps. The incision in the lower uterine segment must be very carefully made, owing to the extreme thinness of this portion of the uterus, it being never more than a few millimeters thick, as any carelessness may result in cutting the child. The placenta is now removed, the uterine wound is closed in two layers by catgut sutures, and the abdominal wall is closed in layers, except at the lower angle of the incision, a small gauze drain being inserted into the deepest part of the wound.

"The amount of hemorrhage is usually not excessive and is easily controlled. There is always some danger of injuring the bladder and of opening the peritoneal cavity, but if the dissection is made with care neither of these accidents should occur. During the separation of the bladder the left ureter and uterine artery are visible in most cases, and, therefore, should be safe from injury, but carelessness may result disastrously. The employment of the Trendelenburg position during the operation is almost imperative. The operation can be performed in the ordinary dorsal position, but the difficulties are so much increased that neither the operator nor the patient has a fair chance."

Rothrock[61] was an enthusiastic advocate of the extraperitoneal operation and had this to say about it:

"The extraperitoneal operation because of its more difficult technic has never become popular. Yet after one has performed it a number of times and has become acquainted with the anatomy and the details of technic it is comparatively simple and easy.

"The technic employed in the present group, while it departs slightly from the usual routine of the extraperitoneal operation as described by most writers, differs only in a few of the details. The following is a description of the technic employed.

"With the head of the table slightly lowered, a median incision is made in the lower part of the abdomen, beginning 5 or 6 inches above and carried down toward the pubes. The incision is made through the fascia down to, but not through, the peritoneum. The peritoneum is then separated from the abdominal wall to the left of the incision until the left border of the bladder comes into view. After a little experience the border of the bladder can easily be recognized. Many recommend partially filling the bladder with a solution of boric acid before beginning the operation, in order to render its outline more easily recognizable, but I have not found it advantageous, and in some instances it has proved a positive disadvantage, because if the wall of the bladder is thin it renders it more liable to injury. Furthermore, if the bladder is partially filled it takes up more room and is less easily retracted to one side. For this reason I always make it a practice to be sure that the bladder is empty. The separation of the peritoneum from the anterior abdominal wall, owing to its loose attachment, is easily accomplished by peeling it off with a piece of gauze, meanwhile care being taken to avoid injury to the large veins which come into view at the left border of the bladder. The bladder having been located, owing to the loosening of its attachment to the

uterus under the influence of pregnancy, with a piece of gauze it may be easily separated from the uterus and displaced upwards and to the right. This blunt dissection is continued until the median line is approached. The bladder is detached from the uterus well down toward the cervix and upward toward the vesico-uterine plica, until an area of the distended cervical portion of the uterus sufficiently large to permit of an incision adequate for delivery has been uncovered. Great care should be exercised as the vesico-uterine plica is approached to avoid tearing through the peritoneum, which is often quite thin, and should this happen the rent should be immediately closed with a fine catgut suture to prevent contamination of the peritoneal cavity. With the bladder well retracted upward and to the right, the preparation is then complete for uterine incision.

"Instead of a diagonal incision extending upward and outward, as is usually recommended, delivery is accomplished through a median incision. The advantages of the median incision are less hemorrhage and less liability of tearing through the vesico-uterine plica during delivery. In a few instances this will happen even with the median incision, but if the rent is discovered and immediately closed there will be no leakage into the peritoneal cavity. With increasing experience the occasional unavoidable tearing through the peritoneum will happen less frequently. With the cervical portion of the uterus laid bare, an incision of sufficient length to permit easy delivery is made in the median line over the presenting head. The amount of bleeding varies greatly; in some the venous sinuses of the uterine wall are enormously distended, while in others the incision leaves an almost bloodless field. For the control of hemorrhage in the uterine wound, which is sometimes profuse, specially adapted triangular clamps are lightly applied over bleeding sinuses, as in all other types of operation. With the aid of the suction apparatus the field of operation may be kept fairly clear of fluids and blood until after delivery, when hemorrhage usually ceases spontaneously. . . .

"Before proceeding to deliver, it has long been my practice to first rotate the occiput anteriorly, regardless of the position in which it may be found, and to hold it in position with the left hand while the blade of the forceps is slipped under it, which will hold it in position until the other blade is applied. This secures the most favorable position for delivery and, besides, the blades of the forceps, on account of their shape, fit better when applied to the sides of the head and are much less likely to cause injury. . . . The application is made exactly as in vaginal application, with the pelvic curve directed upward.

"It is very desirable to make the uterine incision of sufficient length, otherwise considerable resistance to delivery may result, as well as irregular lacerations which may even extend upward through the vesico-uterine plica. Such lacerations are to be avoided, if possible, as accurate coaptation of the wound is more difficult, and imperfect union may result. . . .

"After delivery has been accomplished here, as in all sections, I have adopted a conservative plan for the management of the third stage. Immediately following delivery pituitrin and ergot are given hypodermically. As the placenta is still attached, one may now safely wait until the uterus regains its tone. It is my custom to wait, if necessary, for ten to fifteen minutes, and it frequently happens that the uterine contractions will detach and even sometimes expel the placenta. In case this does not happen, a little gentle massage over the fundus will stimulate the uterus to contraction, frequently with the desired result. In case of failure of the uterus to detach and expel the placenta it is sometimes necessary to separate and deliver it manually, but this is always postponed until the uterus has regained its tone and is well contracted. Here, as in the classical section, if the cervix is uneffaced and undilated, it is then slightly dilated with a uterine dilator from above. . . .

"The placenta having been delivered, the edges of the uterine wound are grasped with volsella forceps at both ends of the incision in order to facilitate the placing of the sutures. The incision is closed by three layers of sutures, the first a continuous suture of fine catgut to approximate the endometrial edges, care being taken to avoid the endometrium. The second layer of interrupted sutures of chromicized catgut, which include the greater part of the thickness of the uterine wall, are then placed. Care is exercised in tying these sutures to avoid excessive tension and strangulation of the tissues; only sufficient tension to approximate the edges should be used. Another continuous suture of fine catgut to neatly approximate the outer edges of the wound completes the closure of the uterine incision. If there is still oozing, perfect hemostasis is secured by ligating all bleeding vessels. The uterovesical fold is carefully examined for possible rents and the bladder is restored to its normal position and its left border attached by a couple of catgut sutures to hold it in place. While the wound is large, if hemostasis is complete, drainage is unnecessary. . . .

"The advantages of the operation are safety and freedom from pain and discomfort following the operation. This feature must be witnessed to be appreciated. Quite frequently patients suffer no more discomfort following delivery by this operation than after a normal delivery, and are able to take nourishment immediately after the effects of the anesthetic have passed. It is moreover free from postoperative complications, especially meteorism and ileus. The operation does not prevent subsequent deliveries by the same operation. In a number of cases a second or even a third operation has been made in the same field without difficulty and no abnormal adhesions have been encountered following previous operations. . . .

"From time to time discussion has arisen over the question as to whether the operation is easier after labor has progressed and the head has engaged, and the statement has been made that early in labor or before the onset of labor the operation is more difficult, because at this time the lower uterine segment is not distended. According to my experience, there is little

difference and, if any, it is in favor of the early operation before the head has engaged and has become impacted. . . .

"Forty-four cases were delivered by the extraperitoneal operation and as familiarity with the technic increased the scope of application of the operation extended, until the latter part of the period it came to be the operation of choice. Of the forty-four cases, nineteen were elective and in twenty-five it was performed after labor had been in progress for some time, as, for example, in nineteen after the test of labor in doubtful borderline cases, in two after the induction of labor with the bag, and in four after an attempt had been made to deliver with instruments. In two of the latter, labor had been induced by the bag.

"There were no maternal deaths and only one stillbirth. . . ."

The above description follows very closely the technic ascribed to Latzko, which the latter reported rather meagerly in the Wiener Klinische Wochenschrift of April 8, 1909.

After a careful study of the different extraperitoneal operations, Jellinghaus[68] selected the Latzko technic for use in the New York Lying-In and the Nursery and Child's Hospitals. Since 1923 he has acted as instructor to most of the men using this operation in these hospitals. In 1930, Steele[68] reported a study of fifty-nine cases done by the Latzko method from the Lying-In Hospital, with five maternal deaths, a mortality of 8.5 per cent. The average number of hours in labor was twenty-eight and one-half, the average number of hours after the rupture of the membranes was twenty-one and one-half.

Burns[9] reported a series of nine Latzko operations at the New York Nursery and Child's Hospital with no maternal deaths.

In 1937, Aldridge[1] reported an interesting modification of the Latzko operation. He describes this modification as follows:

"A study of the anatomic structures around the bladder shows that its musculature is completely surrounded by a thin but definite layer of endopelvic fascia. After incising the abdominal wall, the first step in dissection is to open the layer of endopelvic fascia, covering the anterior surface of the distended bladder by a longitudinal incision in the midline. After this layer has been incised, the bladder can easily be displaced from within its endopelvic fascial capsule on the left side by blunt dissection. As soon as the anterior surface of the lower uterine segment is reached, the layer of endopelvic fascia on the posterior surface of the bladder can readily be seen as a smooth glistening layer. It has been found that this layer can be immediately opened and dissection can more readily be continued behind the layer rather than making further attempt to free the bladder from its fascial capsule. When dissection is continued between this layer and a similar layer covering the musculature of the lower uterine segment, it will be found that a free, practically bloodless, space has been entered and that the anterior surface of the lower uterine segment can readily be exposed. Between these fascial planes the dissection can easily be carried beyond the upper border of the bladder. This is exactly the same almost bloodless space which is entered in displacing the bladder downward in doing the so-called "low flap" cesarean section by the abdominal route."

When the space bared seemed to be too limited to permit delivery without tearing the uterovesical fold of peritoneum, the latter was incised and the freed peritoneal margins were carefully sutured together. The uterus was then opened by a median incision. In addition to drainage of the abdominal incision, a small cigaret drain was placed between the bladder and the lower uterine segment. The drain passed into the vagina from the lower angle of the cervical wound.

Sellheim,[65] following his excellent anatomical studies of the extraperitoneal approach to the lower uterine segment, admonished one to keep close to the midline. He stated, "Je weiter man nach aussen geht, um so ungünsteger werden die Verhältnisse." DeLee,[15] in discussing the extraperitoneal cesarean, says: "It has been learned by bitter experience that the further one advances from the midline the greater grow the dangers of hemorrhage and the more technically difficult each step of the operation becomes."

With this idea of keeping in the "midline" paramount, the writer for some years has used the following technic in reaching the lower uterine segment extraperitoneally:

The patient is placed in a moderate Trendelenburg position. About 100 c.c. of sterile boric acid solution are injected into the bladder through a large rubber catheter which is clamped off and left in situ. A midline incision is made from about 5 centimeters below the umbilicus to the symphysis. This incision extends downward to but not through the fascia except at its lower angle. Immediately above the symphysis the fascia is incised longitudinally for a distance of 5 centimeters. One thus enters the space of Retzius, which anatomically extends from the front of the bladder to the umbilicus, limited laterally below by the hypogastric and above by the inferior epigastric arteries.

Keeping this anatomical fact in mind, the parietal peritoneum is freed from the overlying abdominal fascia, from the space of Retzius upward for two-thirds of the distance to the umbilicus and laterally almost to the outer borders of the recti muscles. The fascial incision is now completed, extending upward to within one-half centimeter of the superior border of the freed peritoneum. This freeing of the abdominal parietal peritoneum allows the bladder to be pulled downward slightly. Under gentle traction the prevesical fascia is incised transversely near the bladder summit. The bladder is easily "shelled out" of its endopelvic (prevesical) fascial envelope and is pushed directly downward in the midline. To provide more room and to lessen the liability of injury to the bladder, the previously injected boric acid solution is now allowed to escape from the inlying catheter. The endopelvic layer of fascia lying behind the bladder (and in front of the lower uterine segment) is now incised transversely for a distance of 4 to 6 centimeters. The lower fascial flap containing the bladder is pushed downward and the upper flap upward. Great care must be exercised in manipulating the upper flap. Separation is much easier if the patient has been in labor several hours. A median incision 9-10 centimeters in length is made in the bared area of the lower uterine segment and the head is extracted slowly and gently with obstetrical forceps. After spontaneous expulsion or manual removal of the placenta, the uterine incision is closed with three layers of continuous chromic catgut sutures. The bladder is allowed to drop back over this suture line. The transverse incisions in the endopelvic fascia are closed by a few appropriately placed interrupted plain catgut sutures. Sterile boric acid solution is again injected into the bladder through the catheter to demonstrate any rents, which, if found, are immediately repaired. The abdomen is closed in layers with a cigaret drain placed in the lower angle of the wound. It is recommended that the operator stand on the right side of the patient, which position facilitates both the dissection of the peritoneum off the abdominal wall from below and the application of obstetrical forceps.

Aside from technical difficulties, which to some men seem to be insurmountable, the main objection to the different extraperitoneal operations lies in the frequency of injuries to bladder and ureters. For that reason a certain number of men prefer the transperitoneal-extraperitoneal operation of Fromme[25]-Veit,[77] or Hirst,[32] as previously described in this paper.

The Gottschalk[42]-Portes[54] operation with very little stretch of the imagination may be classified as an extraperitoneal operation. It is a cesarean section followed by a temporary exteriorization of the uterus. It is a two-stage procedure. The first stage consists in delivery of the pregnant uterus through a long abdominal incision. The abdominal wall is sutured around the uterus at the level of the cervix. A high incision is made in the fundus, as in the regular classical cesarean. The child, placenta and membranes are extracted. The incision is sutured in layers. The uterus is covered with moist packs and allowed to remain on the abdomen.

In the second stage, if the patient demonstrates uncontrollable sepsis, the uterus is amputated extra-abdominally by the Porro technic as soon as her condition warrants; however, if the patient is not too septic, the uterus is allowed to involute outside the abdomen and in twenty to thirty days, the adhesions are freed and it is returned to the peritoneal cavity.

DeLee[16] suggests that the uterine wound be left unsutured, insuring better drainage. The objection to the operation is the prolonged hospitalization.

Gottschalk[42] of Berlin described this operation in 1909 and 1911. Portes[54] of Paris, in ignorance of Gottschalk's work, reported his operation in 1924. A. Couvelaire,[13] in 1925, reported thirty-two cases in which the Portes operation was used, with two deaths, or a mortality of 6.5 per cent. Phaneuf[48] reported a Portes cesarean with recovery in 1927. DeLee,[16] in the 1938 edition of his textbook, states that up to 1935, 220 cases of the above operation had been reported, with a mortality of about 20 per cent.

As stated previously in this paper, the two-flap low cervical operation of DeLee[17,18] or of Beck[4,5,6] is a modification of Sellheim's number four low cervical operation. Many men think that this operation is technically much more difficult than the classical operation, and that it is too time consuming.

Falls[22] in an analysis of fifty-seven cases of low cervical as compared with fifty-seven cases of the classical operation, done by himself, under

as nearly as possible similar operating room conditions, reached the following conclusions:

"1. As regards morbidity and mortality in the series, there appears to be a slight difference in favor of the low cervical operation.

2. As regards postoperative vomiting, ileus and temperature days, hospital days and wound infection, there appears also to be a corresponding slight difference.

3. There seems to be no difference in the postoperative discomfort.

4. There seemed to be less bladder dysfunction after the low cervical than after the classical operation.

5. There is no appreciable difference in the technical difficulty as measured by the operating time.

6. The results obtained by the low cervical operation are hardly so superior to those following the classical operation as to justify the extravagant praise of some of its sponsors."

When, from the desperate condition of the patient, speed in operating is imperative, Krönig's[40] low cervical operation is recommended. A transverse incision is made in the loose visceral uterine peritoneum about one centimeter above the vesico-uterine fold. The bladder is easily pushed off the lower uterine segment by blunt dissection. The bared area of the latter is incised longitudinally, the child is extracted by forceps and following spontaneous expulsion or manual removal of the placenta the uterine wound is sutured by continuous or interrupted chromic catgut sutures. The bladder is sutured over the uterine wound. Krönig[40] considered the peritonealization of the classical cesarean wound inadequate protection against leakage of septic material from the infected interior of the uterus or the uterine wound into the general peritoneal cavity, and thought that the overlying bladder would prevent this.

Beck[6] claims his double flap operation is a modification of the Krönig operation. DeLee[15] considers his and Beck's low cervical operations modifications of the Sellheim number four operation. Their operations are quite similar. They both incise the loose uterine peritoneum transversely half way between the bladder reflection and the gray seam (plica). They dissect up two flaps of peritoneum, an upper and a lower. The upper flap is made by gently passing a pair of blunt scissors, or fingers, under the peritoneum. The lower flap is formed by stripping the bladder off the anterior surface of the uterus by blunt dissection as in abdominal hysterectomy. The denuded area is incised longitudinally and the child is extracted with forceps. After removal of the placenta, the uterine incision is closed by two or three layers of continuous or interrupted catgut sutures. The upper peritoneal flap is brought down and sutured over the superior portion of the closed uterine incision. The lower flap, containing the bladder, is pulled up and sutured to the uterine peritoneum about one centimeter above the original incision. Beck[7] has modified his first operation by leaving an island of undenuded peritoneum about one centimeter wide between the two flaps to which they are sutured, with only slight overlapping.

Beck[4,5,6] and DeLee[17] are strong advocates of the above operation. DeLee,[17] in 1925, reported 390 cases by his technic with three maternal deaths, a mortality rate of 0.76 per cent. Greenhill[27] in 1929 reported 731 low cervical cesareans performed at the Chicago Lying-In Hospital, with nine deaths, or a mortality rate of 1.2 per cent.

Beck,[7] in 1929, Montgomery[45] in 1936, and Quigley[55] in 1937, have analyzed in the accompanying tables the mortality rates of the classical as compared to the low cervical cesarean.

Phaneuf,[49] in 1936, reported 515 personally observed cases of the lower cervical operations (in 292 the transverse uterine incision, of which he is a strong advocate, was used) with an uncorrected mortality of 4.2 per cent. Many of the cases had been given a test of labor of six or more hours.

Phaneuf[49] is a vigorous proponent of the transverse uterine incision. The objections to the above incision are: (1) there is more bleeding; (2) there is danger of the incision tearing across the uterine artery or the ureter; (3) the upper incised portion of the uterine wound retracts and thickens, while the lower portion remains thin, which renders accurate suture difficult; (4) and if pus collects back of the peritoneal flaps under the bladder, the incision is too high to be readily reached and drained through the cervical canal.

Beck[5] thinks that in the infected classical cesarean cases, general peritonitis develops because of a massive spill of infectious material into the peritoneal cavity from the interior of the uterus through a broken down uterine incision. He considers the double flap operation a barrier against this occurrence, and if pus forms under the flaps, it will drain through the cervical wound into the vagina. DeLee[17] is of a like opinion.

CESAREAN SECTION AFTER SIX HOURS OF LABOR IN THIRTY-FOUR BROOKLYN HOSPITALS (BECK)

Hours in Labor	Classic Operation				Low Operation			
	No Vaginal Examinations		Vaginal Examinations		No Vaginal Examinations		Vaginal Examinations	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
6-12	89	5	48	4	13	0	7	0
12-18	50	2	29	4	11	0	3	0
18-24	50	2	45	5	11	0	11	0
24-30	34	2	11	0	4	0	6	2
30-36	18	1	20	2	7	0	6	1
36-42	8	0	6	1	2	0	4	1
42-48	14	1	13	0	8	0	8	1
Over 2 days	10	3	27	11	10	1	12	1
Total cases	472 with 43 deaths; 12.3%				123 with 7 deaths; 5.6%			

Other factors may explain the better results of the low cesarean. Hofbauer,[33] in a histological study of forty-three uteri removed at different times during pregnancy and labor, concludes: "During pregnancy a phagocytic tissue, consisting of monocytes and clasmatocytes, makes its appearance in the base of the broad ligament, and is intensified by the stress of prolonged labor, but particularly by the existence of infection. . . . The presence of this phagocytic tissue in the parametrium must be regarded as a prophylactic biological reaction and as a marked protection against infection."

Schilling[64] states:

"It is a well established fact that tissues exposed more or less constantly to infection will develop and exhibit a corresponding degree of resistance to microbic invasion. And, it is well known, too, that in parts of the body well protected from every form of contamination, such as the mediastinum, for instance, the tissues exhibit a comparatively low degree of immunity against infection.

"So the tissues of vagina and cervix accustomed to battling infection have developed a substantial degree of resistance to bacterial invasion.

"This circumstance will explain why lacerations of the cervix and abrasions in the vagina so comparatively seldom result in dangerous infection. On the other hand, the cavity of the uterus is normally sterile. Consequently, its resistance to infection is comparatively low. So that in this location bacteria may exhibit great virulence, which in the lower birth canal are quite innocuous."

The smaller operative blood loss in the low cervical as compared to the classical cesarean, may contribute in no small degree to the smoother convalescence of the patient. This is particularly evident in those patients who have been in labor several hours. The lower uterine segment is markedly thinned out and bleeds but scantily when sectioned. It is almost a truism that the thinner the cervical zone the less the bleeding.

Greenhill[27] and others claim that the presence of the wound in non-contracting or quiet zone of

EFFECT OF ABDOMINAL CESAREAN SECTION THE PUERPERAL MORBIDITY AND MATERNAL MORTALITY OF CESAREAN SECTION IN DISPROPORTION CASES (MONTGOMERY)

1. Classical elective cesarean section.	
Maternal mortality	1 in 110 = 1.9%
Puerperal morbidity	51 in 110 = 46.0%
2. Classical cesarean section, section after less than 12 hours of labor.	
Maternal mortality	0 in 15 = 0.0%
Puerperal morbidity	8 in 15 = 53.0%
3. Classical cesarean section, section after more than 12 hours of labor.	
Maternal mortality	3 in 38 = 8.0%
Puerperal morbidity	24 in 38 = 63.0%
4. Low cesarean section	
Maternal mortality	1 in 28 = 3.5%
Puerperal morbidity	18 in 28 = 64.0%
Total mortality rate for cesarean section in disproportion	5 in 191 = 2.6%

QUIGLEY'S COLLECTION OF 11,994 CASES

	Cases	Deaths	Rate
Classical Cesarean	5,757	325	5.6
Low Cervical	3,700	66	1.78
White House Conference 138 Hospitals	2,273	134	5.9
Rochester General Hospital (Low cervical)	264	1	0.3
	11,994	526	4.38%

the uterus lessens the tendency to postpartum hemorrhage and favors better healing, thus minimizing the danger of rupture in subsequent pregnancies.

In any consideration of the various types of cesarean section, it must be clearly realized that the time element is by far the most important factor in controlling the mortality rate. No matter how skillful or experienced the operator, no type of operation devised by the ingenuity of man will save the prospective mother from a septic death, if it is done at an unfavorable time.

The maternal mortality is lowest where the operation is carried out before the onset of labor. Even at this favorable time the basic mortality varies from 0 to 2 per cent, and the danger of the operation increases progressively with the advance of labor. Holland[35,36] gives the following illustrative findings in 1,953 sections for contracted pelves:

Time of operation	Number of cases	Mortality er cent
A. Before labor	1202	1.6
B. Early in labor	389	1.8
C. Late in labor	220	10.0
D. After induction of labor	35	14.0
E. After attempt at delivery by forceps or craniotomy	107	27.0
Total	1953	4.3

Stander[67] considers the classical cesarean unsafe after labor has been under way for more than six hours. Peckham's[47] analysis shows a rapid rise in morbidity and maternal mortality after twelve hours of labor.

Histological and bacteriological investigations, as well as clinical experience, prove that the uterus is frequently infected after a prolonged labor. The factors which influence bacterial invasion of the uterus during labor are: (1) vaginal examinations; (2) time of rupture of the membranes; (3) duration of labor; and (4) intrauterine manipulations.

Harris and Brown[30] in a study of fifty cases during labor found positive cultures in twenty-two, thirteen of which had not been examined vaginally; also of the twenty-two patients with positive cultures, seven were infected despite unruptured membranes.

In twenty-nine patients who had been in labor less than six hours when cesarean was done, cultures were sterile in twenty-eight; in the one showing positive culture, although not in labor, the membranes had been ruptured for ten hours. In fourteen of twenty-two infected cases the temperature was normal; the remaining eight patients show elevations of temperature, but two of these were less than 100 degrees F.

From this investigation, Harris and Brown[30] concluded that the uterus was free of bacteria at the end of pregnancy and also during the first few hours of active labor, and that the probability of ascending infection increased with each hour of labor. Their investigations justified the conclusion that ascending infection is probably the most important factor in the causation of the high mortality rate following cesarean section. This ascending infection occurred in the presence of unruptured membranes, and the absence of temperature was no certain criterion that the patient was not infected.

The incidence[39] of cesarean section in the United States averages 2.9 per cent. This is far too high an incidence, leaving us with a maternal mortality rate which startles the rest of the civilized world. To correct this high cesarean rate and indirectly reduce our mortality rate, several suggestions are ventured:

Pay closer attention to pelvic measurements. Realize that external measurements have little value unless one takes accurate internal measurements and also learns to palpate the bony pelvis. Carefully check the above with expert pelvic x-ray measurements, as suggested by Thoms[72-76] and later by Caldwell and Moloy.[10,11,12]

Observe the patient closely in the last month of pregnancy and determine whether the head will enter the pelvic inlet readily. Try to learn when the head is moldable or not by its consistency.

Have a clear conception of what is meant by a trial of labor or the test of delivery. Is the given pelvis too small to venture a test of labor? A trial of labor means allowing the patient to enter labor and closely watching to see if the cervix will dilate, if the head will fix itself in the inlet, and, if fixation occurs, will it engage, as evidenced by the presenting part reaching the level of the ischial spines. A real test of delivery means four to six hours of hard pains every three to six minutes after complete dilation of the cervix with the membranes ruptured.

Besides a contracted pelvis, tumors blocking the birth canal may remain unrecognized until so late in labor that a classical cesarean would be too hazardous. The situation or the size of the tumor may render any of the so-called low cervical or extraperitoneal operations impossible. A pelvic examination early in pregnancy might easily prevent the occurrence of such tragic situations.

A prolapsed cord or arm may be too badly infected for delivery through the general peritoneal cavity. However, delivery by the extraperitoneal or transperitoneal-extraperitoneal route may be comparatively safe for the mother, thus avoiding sacrifice of the child.

Too many patients are sectioned for a suspected contracted pelvis, whereas, if careful pelvic studies were made, it would be clearly realized that the pelvis was of ample size, but that a cervical dystocia was the real cause of the prolonged labor. Many patients entering the hospital for delivery are not in true labor, but are experiencing a preliminary period which may ensue before the development of actual labor. Hamilton[28] has shown that in 539 primiparæ, 375 had a preliminary period of fifteen hours and fifty-one minutes; in 461 multiparæ, 306 had a preliminary period of fifteen hours and seven minutes. It would seem ridiculous to section a woman, in the preliminary stage of labor, for dystocia.

Contracted pelves are not common in the United States, and Dewees[19] wrote in 1828 that he had met only three cases in his large experience. Reynolds,[56] in 1890, reported an incidence of 1.34 per cent of contracted pelves in a series of 2,227 women delivered in Boston. In 1897, Flint[23] reported an incidence of 8.46 of contracted pelves in 10,233 patients delivered at the New York Lying-In Hospital. Williams,[78] in a series of 11,630 women delivered at the Johns Hopkins Hospital, found that 3,100 of them presented a contracted pelvis of some type. In this series the incidence of contraction of the inlet was 8.96 per cent in the white, and 37.31 per cent in the negro women. Six per cent of the series showed a contraction of the outlet, *i.e.*, an intertuberous diameter of 8 centimeters or less. Reports from larger clinics showed that 69 to 81 per cent of these women will deliver spontaneously if labor is conducted properly. Stander[67] gives an incidence of spontaneous delivery of 81.75 per cent; Valency 69 per cent; Peham 72.4 per cent; Bar 76.5 per cent; Bürger 77.8 per cent; Krönig 78.5 per cent; and Baisch 80 per cent.[67]

Schauta,[63] in 49,397 deliveries, found 5,288 contracted pelves, an incidence of 10.7 per cent. Of these women 77.8 per cent with contracted pelves delivered themselves spontaneously with only four maternal deaths, or a maternal mortality of .09 per cent, which would seem to prove that the best that can happen to a woman with a contracted pelvis is to be allowed to deliver spontaneously.

Classical cesarean, at the time of election, should be reserved for those patients who, after careful study, demonstrate clearly their inability to deliver spontaneously; in the border line cases, if after a trial of labor of not much more than six hours, there is no progress, the low cervical operation of DeLee,[17], Beck,[4] or Krönig[40] is recommended; if labor has continued for twelve hours, or if the membranes have been ruptured for more than four hours, and the patient is not exhausted and presents a normal temperature and pulse, one of the various types of transperitoneal-extraperitoneal or a real extraperitoneal operation should be the operation of choice.

In contemplating any type of cesarean operation, it must be clearly realized that puerperal infection is a wound infection. One must hesitate to place a wound in the uterus and soft tissues in the presence of an existing infection, as evidenced by a high temperature, rapid pulse and foul vaginal discharge. Even a pubiotomy should not be considered (which facilitates delivery best where there is a contraction of the outlet); only a craniotomy will give the woman her greatest chances of survival. For religious reasons or because of a great desire on the part of the parents for a child, one might consent to undertake a Porro operation in the face of an existing infection. But it should be clearly explained to the patient that the mortality of the above operation averages from 1.56 (John W. Harris)[29] to 17.4 per cent (Eardley Holland).[36] Facing the same circumstances in a young woman, in order to save the uterus, one might give serious consideration to the Gottschalk-Portes operation (mortality 20 per cent, DeLee).[16]

In summing up the question of which type of cesarean section to employ, it must be clearly realized that the ideal operation is one that offers

the greatest safety to the patient and is technically not too difficult for the average surgeon. The low cervical operation according to the technic of Krönig,[40] Beck,[6] or DeLee[17] seems best to meet these requirements. If one fears the peritoneal spill encountered in this operation, and is technically competent, he may approach the uterus extraperitoneally; if not technically competent, it is recommended that he employ the simpler technic of the Fromme,[25] Veit,[77] or Hirst[32] operation.

From the statistics quoted in the above paper, it appears clearly evident that the borderline case can be given a longer trial of labor with a far greater margin of safety to the patient when any of the various types of low cervical operation are employed than with the classical cesarean.

Finally, the obstetrician and surgeon must be keenly awake to the fact that it is clear thinking rather than expert operating which, in general, offers the greatest chances of recovery to the patient; an exhausted or a frankly infected subject is a poor risk for any type of operative procedure, whether it be a craniotomy, pubiotomy, a Porro cesarean or any of the various types of low cervical or extraperitoneal cesareans described in this paper.

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FURTHER RESULTS IN THE TREATMENT OF ACUTE POLIOMYELITIS WITH ANTISTREPTOCOCCIC SERUM* (1928-1937)

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IT has been conclusively demonstrated time and again that the inciting agent of acute epidemic poliomyelitis is a filtrable virus as now understood. Studies of the virus have yielded information of great value regarding the pathogenesis of this disease but these studies, it can truly be said, have yielded little of practical value for specific prevention and treatment and little information as regards the source of the virus. Convalescent serum could not solve the problem because the disease would have to continue to occur in virulent form, with its dire consequences, in order to insure a supply. Virus vaccines containing cord tissue obtained from monkeys that had succumbed to poliomyelitis could not be prepared in sufficient amount for general use.

Impressed by the early work on the streptococcus (1916) when Towne, Wheeler and I first demonstrated it in and isolated it from the nasopharynx and the lesions in the spinal cord of human beings and monkeys that had succumbed to poliomyelitis, I have continued to study this disease by special methods from the point of view of both the streptococcus and the virus in the hope that effective methods for specific prevention, diagnosis and treatment might be found. Reports of results on different phases of the problem,[3,7,8,10,12,15] including treatment of the disease with the antistreptococcic serum,[5,6,7,11,13,14] have been made from time to time. The results of treatment of the disease with the antistreptococcic serum have been corroborated by independent observers.[1,2,4,16,17]

A comprehensive review of this work, together with important unpublished data, will be published elsewhere. Suffice it to state at this time that all reasonable requirements for establishing the causal relationship between the streptococcus and this disease now have been fulfilled, including the demonstration of streptococcal antigen in the serum of patients and monkeys during the acute stage of the disease and demonstration of streptococcic antibodies during convalescence, and the making of the virus from the streptococcus.[9]

Monkeys have been immunized against the vi-

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TABLE I. RESULTS: TREATMENT OF ACUTE POLIOMYELITIS WITH ANTISTREPTOCOCCIC SERUM: 221 PATIENTS RECEIVING SERUM AND 116 PATIENTS NOT RECEIVING SERUM

Groups	Patients	Deaths		Patients*	Residual paralysis				
		Number	Per Cent		None	Slight	Moderate	Severe	
								Number	Per Cent
Serum given	221	10	4.5	211	161	29	14	7	3.3
Serum not given (controls)	116	23	19.8	93	34	10	17	32	34.4

*Patients out of 221 who received serum and survived and those out of 116 who did not receive serum and survived.

rus of poliomyelitis with vaccine prepared from the streptococcus. Serum obtained from horses immunized with the streptococcus has been shown to neutralize the virus and to have curative action on poliomyelitis among monkeys and human beings.[7,11] The results of the intradermal injection of the antistreptococcic serum and the precipitation test performed with this serum, and the serum of patients, have been shown to be diagnostic of poliomyelitic infection, especially early in the prepoliomyelitic and preparalytic stages of the disease.[10] It is the purpose of this paper to record additional results achieved by the use of antistreptococcic serum in the treatment of acute epidemic poliomyelitis.

This paper is composed of, first, results obtained in the treatment of patients who have received the serum since 1928 under my supervision and under the supervision of physicians to whom I sent the serum at their request; and second, effects of the disease among patients who lived under conditions comparable to those of the first group, and who had attacks of similar severity at about the same time during the same outbreaks of the disease, but who did not receive the serum. Results in the course of the disease among the two groups of patients are compared. The results observed by attending physicians were recorded and reported in the form of answers to a questionnaire sent with each lot of serum. Only cases in which information left no reasonable doubt as to the correctness of the diagnosis of acute poliomyelitis were considered.

Altogether, cases representing 337 patients were available for analysis; in 221 of these serum was administered and in 116 serum was not administered (Table I). Of the 221 patients who received serum, 137 were males and eighty-four were females. Of the 116 patients used as controls, seventy-seven were males and thirty-nine were females. The ages in the two groups were comparable. The initial symptoms in the group in which serum was administered were somewhat more severe than the initial symptoms in the control group.

Thus, the initial symptoms for 188 patients of the group in which serum was administered were considered to be severe in seventy-nine instances (35.7 per cent), moderate in eighty-two (37.1 per cent) and mild in twenty-seven instances (12.2 per cent). The initial symptoms for ninety-three patients of the group of controls were considered to be severe in twenty-seven instances (28 per cent), moderate in forty-two (45 per cent) and mild in twenty-four (26 per cent). Since protocols of individual patients to whom treatment with serum was administered have been reported previously,[6] they are omitted from this report.

In view of the fact that many patients were treated and reported on by physicians with limited experience in the treatment of poliomyelitis, I have summarized the results according to the two most important consequences of this disease, death and residual paralysis, in Table I. Errors in judgment as regards minor effects observed were thus almost wholly eliminated. Moreover, in order to eliminate other possible criticism, all patients who received serum were included, regardless of the amount, or the time of the administration, of the serum after the onset of symptoms and regardless of the condition of the patient.

Of 221 patients who received the serum, ten (4.5 per cent) died, whereas of the 116 control patients who did not receive serum, twenty-three (19.8 per cent) died. Of the 211 patients who had received serum and who survived, 161 recovered without having residual paralysis, twenty-nine had slight paralysis, fourteen had moderate residual paralysis and only seven (3.3 per

cent) had severe residual paralysis. In contrast, of ninety-three patients in the group of controls who survived, only thirty-four did not have residual paralysis, ten had slight paralysis, seventeen had moderate paralysis and thirty-two (34.4 per cent) had severe residual paralysis.

The serum was injected intramuscularly once or twice daily in amounts ranging from 5 to 20 c.c., depending on the age of the patient, severity of symptoms and results obtained. The serum used consisted of one part of the centrifugated euglobulin (bacterial-antibody) fraction of the antiserum of horses hyperimmunized with the heat-killed poliomyelitic streptococcus, dissolved in nine parts of physiologic salt solution rendered 0.2 per cent phenol. The euglobulin was precipitated by diluting one part of whole serum with nine parts of slightly acidulated distilled water. Only strains of streptococci freshly isolated from the nasopharynx, spinal fluid or brain and spinal cord of human beings and from the spinal fluid or brain and spinal cord of monkeys that had succumbed to poliomyelitis—that is, only strains that had "neurotropic" cataphoretic velocity and that produced flaccid paralysis in rabbits—were used for the immunization of horses. These strains were kept in a dense suspension of two parts of glycerol and one part of a solution of 25 per cent sodium chloride throughout the period of immunization. The serum was obtained from horses after the content of antibodies had become high, and usually after one to five years of weekly intravenous injections of the streptococcus.

In 188 of the 221 patients to whom serum was administered, the number of injections and the total amount of serum administered were recorded. To these patients, a total of 508 injections was administered, representing 7,670 c.c., or an average of about 15 c.c. at each injection, and 40 c.c. for each patient. The amount of serum administered per patient ranged from 10 c.c. to 200 c.c. Forty-nine patients received only one injection of 10 c.c. or more, nine received two injections which were twelve to twenty-four hours apart, thirty-one received three injections, twenty-eight received four injections, twenty-six received five injections and twenty-three received six injections or more. The incidence of immediate and late reactions to the serum was obtained in the treatment of 153 patients. Only one person had an immediate severe reaction to the serum, three had a moderate reaction, three a slight reaction and 146 had no immediate reaction. Six patients had severe late reactions, fifteen had moderate reactions, twelve had slight reactions and 120 did not have a late reaction.

Of the ten patients who died in the group that received serum, all had marked paralysis before the serum was administered. The serum was administered to three patients on the second day of illness, to four on the third day and to three on the fourth day. In five of these patients respiratory paralysis had developed before the first dose of serum was injected. Seven patients were adults twenty to forty-eight years old, one was fifteen years old, one was twelve and one was three and a half years old. The number of cells in the spinal fluid of six patients who died ranged from 30 to 640; the average was 517 cells. Severe symptoms characterized all patients from the onset of the disease.

Of the seven patients to whom serum was administered and who recovered with severe residual paralysis (Table I), five had severe paralysis before treatment with serum was instituted and two had moderate paralysis. In only one instance was the first injection made as early as the second day after the onset of symptoms; in two, on the third day; in two, on the fourth day, and in two on the seventh day. The number of cells in the spinal fluid of four of these seven patients ranged from ten to 250 cells; the average was 139 cells. The ages of these seven patients ranged from one and a half years to twelve years and averaged four years. The average time of the first injection of serum was 4.7 days after the onset of symptoms.

Of the twenty-nine patients who had slight residual paralysis after treatment, twenty-one had a severe degree of paralysis and two did not have any paralysis at the time of the first injection of serum. The number of cells in the spinal fluid of seventeen patients ranged from thirty-one to 329; the average was 126 cells. The ages of the patients ranged from six months to forty years, and averaged ten years. The average time of the first injection of serum after onset of symptoms was 3.5 days.

Of the 161 patients who eventually recovered without residual paralysis, 106 did not have paralysis, eight had slight paralysis, six had moderate paralysis and forty-one had severe paralysis, at the time of the first injection of serum. The

ages of patients in this group ranged from six months to twenty-seven years, and averaged 8.2 years. The number of cells in the spinal fluid of 100 patients ranged from eleven to 800 cells; the average was 146 cells. The average time of the first injection of serum after the onset of symptoms was 2.3 days.

Comment and Summary

The results of treatment with poliomyelitis antistreptococcic serum of an additional series of patients suffering from poliomyelitis are reported. The severity of the disease at the onset, the ages of the patients concerned and the number of cells in the spinal fluid of the patients were about the same for the four groups of patients who received serum and who recovered with no paralysis or with varying degrees of residual paralysis.

The degree of residual paralysis that resulted was in direct proportion to the duration of the disease before the administration of the serum. Thus, among those patients who recovered with severe residual paralysis, the average duration of the disease before serum was administered was 4.3 days; among those who recovered and had moderate residual paralysis, the average duration of the disease before serum was administered was 4.7 days; among those who recovered and had slight residual paralysis the period was 3.5 days, and among those who did not have residual paralysis it was 2.3 days.

The much lower mortality (4.5 per cent) and much lower incidence of severe residual paralysis (3.3 per cent) in the group to whose members a serum had been administered in comparison with the mortality (19.8 per cent) and incidence of severe residual paralysis (34.4 per cent) in the group of controls seem directly attributable to the action of the antistreptococcic serum.

Favorable results were consistently obtained each year among the different groups of patients treated and with each of the different lots of antiserum used. Evidence of the beneficial action of the serum was not limited to the effect on mortality and on the final outcome as regards residual paralysis. Beneficial action was noted at the bedside among nearly all patients to whom serum had been administered early, especially in the treatment of those patients who were in the preparalytic stage, and in many instances even after paralysis had begun to afflict some patients.

Restless, nervous children often fell asleep soon after receiving the first injection of serum. This was true alike of patients for whom spinal puncture was or was not made at the time of the injection of serum. Headache and pain in the involved extremity or part often were lessened or relieved. The temperature, especially among patients in the preparalytic stages, rapidly decreased to normal, usually after an initial transient elevation.

Progressive paralysis often was seemingly arrested. Restoration of muscular function was apparently more rapid among patients who received serum than among those who did not receive the serum. These favorable results, obtained since 1928, are in strict accord with those previously reported.[6,7,13,14]

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RECENT PROGRESS IN OTOLOGY*

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PROGRESS in otology in past decades compared with other medical specialties has been embarrassingly slow, largely because of the inaccessibility of the ear and the crudeness of available methods employed in research and clinical practice.

Recently the application of electro-acoustic principles, radical improvements in surgical technic, revolutionary discoveries in chemotherapeutics and the recognition of overlooked factors which produce ear pathology have greatly increased our knowledge of the causes, prevention, treatment and alleviation of diseases of the ear.

Much of this newly acquired knowledge has been widely disseminated, sometimes in a sensational but impressive manner, by popular health talks, radio broadcasts and articles in the press. As a result, the intelligent layman not infrequently seems better informed regarding otological progress than the busy family physician. New responsibilities have thus been imposed on the medical profession in that the public today demands of the otologist and the general practitioner better service in the care of ear diseases than has been given in the past.

Therefore it seems appropriate for our better orientation to briefly indicate some of the recent advances in this field.

The development of the audiometer marked the beginning of a new era in otology. Its extensive use as an instrument for accurately measuring hearing acuity has made valuable research possible and revealed many important facts.

It early proved the inadequacy of our older methods for the detection of slight but significant hearing defects, the first requirement for solving the problem of faulty hearing.

It has disclosed a surprisingly large number of persons who have a handicapping or a potentially handicapping hearing loss, often unrecognized and neglected. The number in the United States is believed to be at least 10 million.

It has proved that among school children[10] hearing deficiencies, frequently so slight as to be overlooked, cause repetition of grades, speech defects, inferiority complexes and behavior problems which interfere with the development of a personality which will insure the individual's economic and social security. Recognition of this fact has resulted in recent legislation in several states making mandatory the periodic testing of the hearing of all school children by the audiometer[11] as the most effective means of conserving the hearing.

The chief obstacle to the more general adoption of this procedure has been the high cost of equipment. Very recently simple, reliable audiometers[12] especially designed for expeditiously and accurately testing large groups for school and industrial purposes have been released at a price so low that small communities with limited budgets can well afford to own them.

The audiometer has been found indispensable by otologists and is being rapidly adopted by general practitioners, school, public health and industrial physicians. In forensic work it has been found to be invaluable. Many physicians now use it in the periodic health examinations of their private patients.

The Council on Physical Therapy of the American Medical Association[3] is rendering valuable service by formulating minimum specifications for reliable, standardized audiometers which can be sold at a moderate cost, thus safeguarding the purchaser against obtaining an inferior instrument.

Several million hearing tests with the audiometer have emphasized certain facts with which every physician should be familiar:

1. Accuracy in applying any hearing test is impossible in the presence of masking or distracting noise; and in making the test, the better hearing ear must be excluded. These simple but fundamental rules are too often ignored.

2. Handicapping hearing deficiencies appearing in adult life are very frequently the result of inflammatory processes in the ears in childhood.

3. Many individuals sustain a material hearing deficiency long before they themselves are conscious of their loss. This fact emphasizes the great importance of periodically testing the hear-

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ing at all ages by scientifically approved methods.

It is to be noted that today many more causes of hearing impairment are known than in the recent past. We mention the following:

Otologists in increasing numbers have accepted the teachings of Wittmaack,[19] first published twenty years ago after extensive research. He showed that many inflammatory ear diseases and their complications have their origin in non-infectious, irritative reactions of the middle ear mucosa, caused by the entrance of non-infectious amniotic fluid and other maternal discharges. These are aspirated and forced through the tubes into the middle ear by the infant at the time of delivery. Such irritation causes abnormal development of the middle ear mucosa, whereby normal pneumatization of the mastoid is prevented and the capacity of the middle ear to resist infection is lessened.

Taylor[16,17] has shown that the administration of quinine to expedite labor and the use of salicylates and arsenicals may cause deafness in the child. Evidence confirming Taylor's belief has been published by Mosher,[9] who found that after the administration of quinine, salicylate of soda and mapharsen to guinea pigs, destructive hemorrhages were found in the cochlea of the feti. Other investigators have found quinine and other drugs in the brain and cerebro-spinal fluid of infants whose mothers had been given these substances.

An important cause of hearing impairment among children has been reported recently in several papers by Crowe[2] and his associates. This is the presence of partially obstructing lymphoid tissue in and about the pharyngeal ends of the eustachian tubes. Its presence can be demonstrated by the nasopharyngoscope. The characteristics of this condition are early retraction of Shrapnell's membrane, hearing impairment first appearing in the upper frequencies of 4096 d.v., 8192 d.v., and higher, detectable only with the pitch range audiometer. Not until the hearing impairment has become more noticeable do the lower tones become materially reduced. This is contrary to our former teaching and is an outstanding contribution to our knowledge. Inflation proves unsatisfactory even after surgical removal of the adenoids. Brilliant results follow treatment of selected cases by irradiation with radium or the x-ray, a treatment to be safely and effectively administered only by those especially skilled in radiology.

The above facts merit the serious consideration of all practitioners, but especially the obstetrician and the pediatrist.

From a scientific viewpoint, old age should not be considered a specific cause of severe hearing impairment. Physiologically there is a slow, gradual, measurable diminution of acuity for the higher frequencies with advancing years. This is not sufficient to produce a handicapping defect for hearing speech. Other factors have been operative during the life of the individual.

The treatment of middle ear infections and their complications caused by streptococci of the beta-hemolytic type and other susceptible organisms has been revolutionized by the use of sulfanilamide[6,15] and related drugs. The reduction of the high mortality in cases of otitic streptococcus meningitis when this treatment is combined with adequate surgery is dramatic.

No other drug has received so much attention in medical literature. It would be idle repetition to discuss this subject further than to offer a few remarks based on recent observation and experience. Disappointment from its use may come from several causes. One is failure to observe closely the carefully prepared instructions of the manufacturers.

In acute middle ear infections early identification of the invading organism is important. When clinical symptoms point to a severe streptococcus infection, one often cannot afford to wait for the bacteriologist's report before beginning drug therapy. Failure may result from neglect to use the drug until after a complication has developed, from inadequate, uncontrolled dosage, or from its too early discontinuance.

What is most to be feared after a mastoid involvement has been clinically diagnosed is a false sense of security assumed because of a subsidence of symptoms. It is believed on competent authority that these drugs do not possess the same bacteriostatic power to overcome microorganisms when confined in collections of pus in closed or partly closed cavities such as exist in a confluent mastoiditis, an epidural abscess, brain abscess, or an abscessed lateral sinus thrombosis, as they exercise in tissues having a freely circulating blood supply.

Cases of this type are encountered in which,

after several weeks of latency, there appears abruptly a serious endocranial complication.

One can avoid such occurrences only by exercising extreme vigilance. So long as there is any purulent discharge from the middle ear, even though it be sterile, and so long as the hearing does not return to normal or nearly normal, or the tympanic membrane remains pale, lusterless and thickened, the patient should be kept under careful scrutiny and be checked at frequent intervals by roentgenographs of the mastoid, and examinations of the blood, and when indicated, of the cerebrospinal fluid. Evidence of progressive bone destruction, meningeal or labyrinthine irritation, facial paresis or a complete loss of hearing demand immediate, thorough, exploratory surgery.

There have lately been decided advances in the surgery of the temporal bone tending toward earlier and more thorough operative intervention. The term "simple mastoidectomy" is fast being supplanted by "complete mastoidectomy," more accurately to describe what should be done in the attempt to effect a cure in destructive suppuration of the mastoid body. This means the thorough removal of all accessible diseased bone and the provision of adequate drainage from remote parts, as the tip, peri-labyrinthine, petrous and zygomatic cells, and exposure of the dura and lateral sinus whenever necessary to explain the symptoms.

The classic radical mastoid operation is less frequently performed than formerly, especially in cases in which the more conservative, modified radical operation, with preservation of the ossicular chain and the tympanic membrane, promises equally good surgical results and a better prospect of improving the hearing.

The endaural as distinguished from the postauricular approach to the attic, middle ear, labyrinth and mastoid body is growing in favor among otologists, since it affords greater accessibility.

The most revolutionary advance in otologic surgery has been the long awaited, successful, one-stage fenestration operation of the bony labyrinth to improve the hearing in otosclerosis. This has lately been attained after persistent effort by Lempert.[8] He recently reported seventy-two such operations, forty-four of which gave brilliant results in improved hearing, surpassing the reported results of the few other operators in this field. The object of the procedure is to secure by a plastic operation a permanent fistula in the external bony semicircular canal, covered by a thin vibrating membrane obtained by transplanting a part of the drumhead. By thus again mobilizing the perilymph, the hindrance to sound perception by air conduction caused by fixation of the stapes is overcome.

The operation requires much time and great skill in plastic surgery in operating in an extremely small space. This can be acquired only by long study and highly specialized training.

It should be undertaken only on persons who still have good hearing by bone conduction, a large auricular canal and a normal tympanic membrane as established by a thorough otological examination. These requirements definitely restrict its application to relatively few of the thousands of otosclerotics who would make every sacrifice to recover useful hearing. This should be made known to those whose hopes have been raised to a high level by sensational newspaper reports regarding this operation.

Notable progress in ameliorating the condition of the aurally handicapped has resulted from recent improvements in the design and performance of electrical hearing aids. Many new features, developed in rapid succession by competing manufacturers, have confused the physician and sadly perplexed the prospective purchaser. In his helplessness against the high pressure salesmanship of certain vendors of hearing aids the patient confidently looks to his physician for help in selecting the hearing device which will best meet his requirements.

This important service can be rendered most satisfactorily after a careful otological examination, including audiometric tests for both bone and air conduction. With the information thus obtained one can specify whether a carbon type hearing aid will prove satisfactory or the patient will need one of the recently developed, compact, wearable vacuum tube types, which afford greater amplification and greater fidelity; also whether a bone conduction or an air conduction receiver is indicated.

The patient with a severe hearing loss showing great differences of acuity at various frequencies presents a difficult problem. Since different instruments possess definite but subtle differences

in their performance characteristics, capable of modification within certain limitations by selective amplification, the prospective purchaser should have the privilege of trying out the instruments of several reliable makers by the intelligibility test.[4,5,7,14] Such comparative tests must be made under identical conditions by one who is not financially interested in the sale of any hearing aid, preferably a physician familiar with this simple procedure.

The Council on Physical Therapy of the American Medical Association,[3] after thorough investigation, has pronounced the hearing devices of several manufacturers "acceptable" according to minimum standards of construction, performance and distribution set up by its Committee on Audiometers and Hearing Aids. Such accepted instruments are naturally recommended in preference to instruments of uncertain background.

The development of the wearable miniature vacuum tube type of hearing aid is a very recent accomplishment. For many whose hearing loss is extreme it often gives great satisfaction when the carbon type fails. Its advantages are the possibility of greater amplification without distortion. Its disadvantages are that it is more vulnerable and that when it suddenly fails to operate, it must be sent to the maker for repairs. The carbon type usually gives warning of impending trouble and can be reconditioned promptly by the nearby distributor. Vacuum tube aids at present have larger battery consumption than the carbon type.

The newer hearing aids have a far wider field of application than their predecessors. Persons with a moderate hearing loss who could not tolerate the adventitious noises of the old carbon transmitter available a few years ago can use a modern hearing aid with great comfort.[1,18]

Young children whose hearing loss prevents them from acquiring normal speech, by using these devices in the home and schoolroom can acquire speech normally and can receive their education in the local schools.[10,13]

It is a serious mistake to advise a person with a progressive hearing loss to postpone the purchase of a hearing aid as long as possible. By so doing he greatly increases his difficulties in becoming accustomed to one. Everyone who has a handicapping hearing impairment should be advised to begin early to perfect himself in the art of speech reading to further supplement his hearing deficiency and enable him to keep his contacts in order to preserve his economic and social security. The hard of hearing person should be emphatically told that the purchase of a hearing aid is not the final solution of his hearing problem, but that he should do everything in his power, under the best medical guidance, to preserve his residual hearing by removal of all detectable causes which might produce further loss.

Conclusions

1. A better knowledge of fundamental otological facts affords a larger opportunity for the otologist, pediatrist and general practitioner to render more effective service.

2. Effective reduction of the high incidence of hearing deficiencies can be accomplished by the general adoption of the routine, periodic hearing test by scientifically approved methods, especially among school children, and continued as a part of the periodic health examination at all ages.

3. Improved hearing aids now available have a wider field of application than in the recent past. In prescribing or selecting them to best meet the specific requirements of each individual, the otologist or interested physician can render valuable help in protecting his aurally handicapped patients from obtaining an unsuitable or inferior device.

4. In selected cases, fistulization of the labyrinth in the hands of qualified operators promises the restoration of useful hearing for a large number of otosclerotics. Many who are not suitable subjects for the operation can successfully supplement their handicap by a modern hearing aid and lip-reading.

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MANAGEMENT OF POSTOPERATIVE INTESTINAL OBSTRUCTION COMPLICATED BY HEMORRHAGE ON THE BASIS OF PROTHROMBIN DEFICIENCY*

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PRESENTATION of this case is being made for three reasons: (1) the early age at which malignant change was found in a polyp of the colon, (2) the success of conservative treatment of intestinal obstruction and (3) the occurrence of bleeding and a deficiency of prothrombin in prolonged intestinal obstruction.

Fig. 1. Evidence of a polyp near the splenic flexure is indicated in the film on the left; evidence of a large polyp in the transverse colon and a polyp in the sigmoid is indicated in the film on the right.

A boy, seven years of age, of Irish parentage, was first seen at The Mayo Clinic on December 19, 1938. Rectal bleeding had been observed intermittently ever since the patient was three months of age. The loss of blood was slight and at times there was freedom from bleeding for as long as two years. In the six months before coming to the clinic the bleeding had become more frequent and severe than formerly and the patient often passed a cupful of blood a few minutes after a normal stool. His health and development were excellent except that there was pronation of his feet. He weighed 67 pounds. There was no history of malignancy in his family. The examination revealed 14.0 gm. of hemoglobin per 100 c.c. of blood, and no abnormality of either the erythrocytes or the leukocytes was present. The findings on urinalysis were within normal limits and the results of flocculation test of the

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blood and roentgenologic investigation of the thorax were negative.

A proctoscopic examination revealed three small rectal polyps and roentgenologic investigation of the colon was advised. The roentgenologist employed the double contrast method and reported, "A polyp 1.5 by 1.5 cm. in the descending colon just below the crest of the ilium; another smaller polyp in transverse colon adjacent to the splenic flexure, and a third large polyp in the transverse colon just to the right of midline" (Fig. 1).

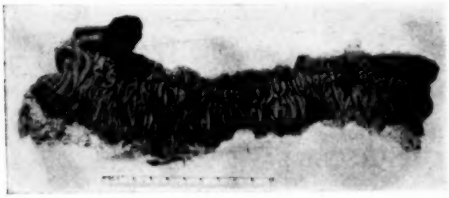

Fig. 2. Segment of colon opened to show the polyps.

An operation was advised. After thorough preparation this was performed by one of us (Dixon) on January 10, 1939. The three polyps were readily located. Careful palpation of the ascending colon and right half of the transverse colon showed no abnormality. Resection of the transverse and descending colon was carried out, removing the colon down to the first part of the sigmoid. The ends of the colon were inverted and a side-to-side anastomosis was established between the hepatic flexure and first portion of the sigmoid. The operation was carried out in one stage because the application of clamps for closure of a colostomy would have been extremely difficult and would have been attended by the hazard of injury to the retroperitoneal portion of the duodenum and the left ureter. A Witzel type of enterostomy was established at a site about 15 to 20 inches proximal to the cecum.

The pathologists reported that the specimen was composed of 28 cm. of transverse and descending colon. Some of the acini in a polyp 4 cm. in diameter in the transverse colon showed early carcinomatous change grade 1. The two polyps (0.5 cm. and 1 cm.) in the descending colon were adenomatous. If the gross appearance of the specimens is of any interest, this is shown in Figure 2. Figure 3 depicts the area of early carcinomatous change and also one of the adjacent adenomatous polyps for comparison. In one field in the region of malignant change, under high power, thirteen mitotic figures were counted.

This patient's immediate postoperative course was satisfactory, with the exception of a questionable reaction from a transfusion on the fourth and sixth postoperative days. However, on the sixth day signs of high intestinal obstruction developed, the output by nasal suction rapidly rising to 3450 c.c. on the ninth day (Fig. 4). Because of fever which had persisted since operation, abdominal tenderness and the absence of isolated, crampy pain, conservative treatment of the intestinal obstruction was instituted. Distention persisted in spite of transduodenal drainage with the Sawyer tube, and a Miller-Abbott type of tube was passed on the thirteenth day. When this entered the jejunum on the fifteenth day there was almost immediate relief of obstruction, as evidenced by diminished output from suction and profuse drainage from the enterostomy tube (Fig. 4). The nasal tube was removed and the diet was gradually increased. Obstruction recurred. This was at first only partial but gradually increased and became nearly complete by the twenty-fifth postoperative day. On the evening of that day he began to pass blood per rectum and by 4 o'clock the next morning a total of 800 c.c. had been passed. The Quick prothrombin

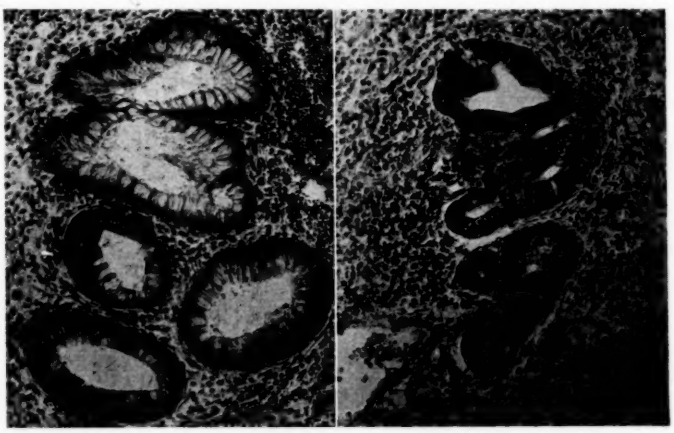

Fig. 3. Malignant change. The acini on the left show simple hypertrophy, the cells contain much mucus and an occasional rare mitotic figure is seen. The acini on the right show absence of mucus, irregular arrangement of cells and numerous mitotic figures.

time measured two minutes and twenty-one seconds. A transfusion of 500 c.c. of citrated blood was given in divided amounts.

The abdomen was reopened. A large edematous dilated loop of small intestine was encountered. Because pain. Since the enterostomy had brought about release of the obstruction at the proximal end of the upper loop, it was possible to introduce vitamin K by nasal tube into the duodenum. Accordingly, 2 c.c. of Klotogen and 6 gm. of bile salts were given by nasal tube;

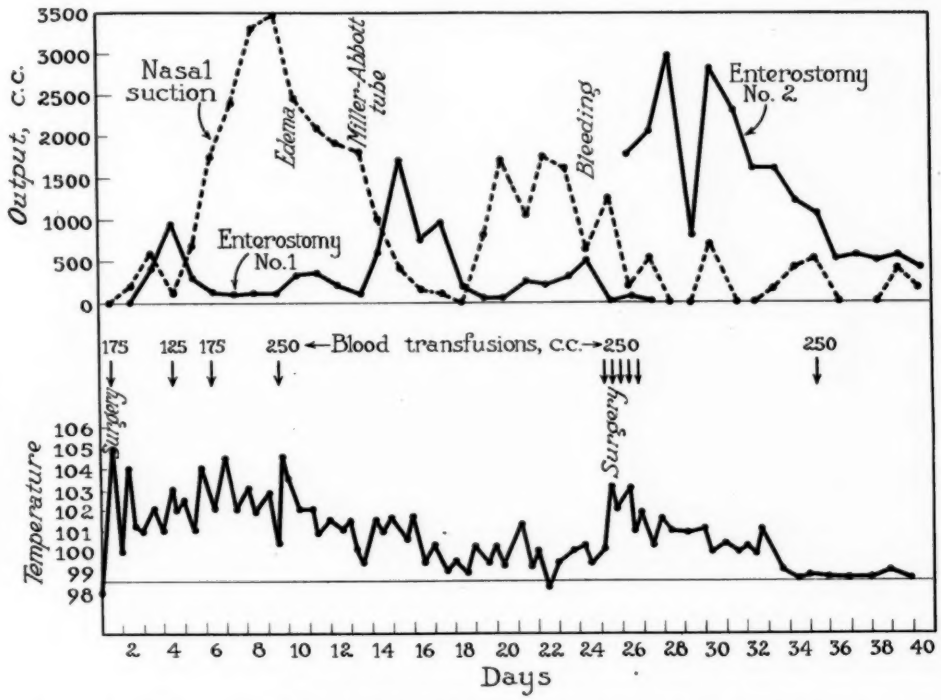

Fig. 4. Postoperative course; relation of febrile reaction to output by nasal suction and enterostomy tubes.

of the critical condition of the patient an exhaustive exploratory procedure was not carried out. An enteric stoma of the Witzel type was established in the dilated loop of bowel. Profuse rectal bleeding continued for eighteen hours following enterostomy, and 750 c.c. more of citrated blood was given by transfusion. The obstruction in the upper end of the dilated loop of bowel was relieved promptly by enterostomy, and this was followed ten days later by release of the obstruction at the lower end of the loop. That the new enterostomy was the means of relieving the obstruction at the upper end of the loop is evident from the fact that material flowed out of the new opening promptly and the output by nasal suction was diminished; release of the lower obstruction ten days later (Fig. 4) was shown by cessation of drainage from the enterostomy tube and by the establishment of a normal fecal content in the bowel.

On the day of operation (after 750 c.c. of blood had been given), the prothrombin time (Quick) had fallen to forty-four seconds. Capsules of vitamin K were given that day through the original enterostomy tube but had to be discontinued because of severe cramping

500 c.c. of citrated blood was also given in the twenty-four hours following operation. By the end of that period all bleeding had ceased, the Quick prothrombin time (Fig. 5) had fallen to twenty-four seconds and the Smith quantitative test revealed 51 per cent normal concentration of prothrombin in the blood. Two cubic centimeters of Klotogen with bile salts was administered on each of the successive four days. At that time, the tube was removed but further therapy with vitamin K was carried out by giving it in capsule form for the next six days. This maintained the Quick prothrombin time between nineteen and twenty-one seconds.

After establishment of the second enteric stoma it was observed that material given by mouth appeared in the drainage from the enterostomy in one hour. To utilize all possible digestive and absorptive surface, the drainage from the proximal enterostomy tube was incubated for four hours and then was introduced into the terminal portion of the ileum through the lower or original enterostomy tube.

During the period of obstruction this patient was also given 25 mg. of betaxin representing 8300 units of vitamin B, and 4 c.c. of cevitamic acid (400 mg.) by vein.

On the tenth postoperative day, edema of the eyes, legs and scrotum developed, but prompt relief followed the administration of 110 grains (7.15 gm.) of ammonium chloride by enterostomy tube in three days.

At the last report on April 27, 1939, the patient weighed 76 pounds, 9 pounds more than when he first came under our care, and he was attending school regularly and leading a normal life. He is to return for fulguration of the polyps in the rectum. Because of the possibility of development of further polyps in the colon and the advantage of early recognition of such lesions, the condition of the intestinal tract should be observed at frequent intervals in the future.

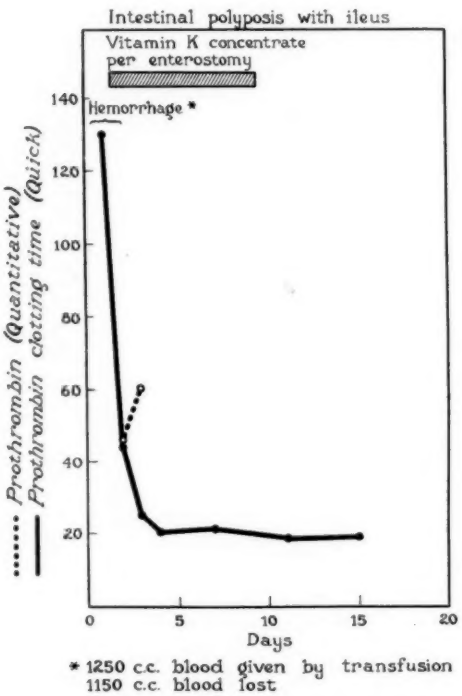

Fig. 5. Prompt return of the prothrombin time (Quick) and quantitative prothrombin to nearly normal values after transfusion and administration of vitamin K concentrate; after the first day the vitamin K was given by nasal tube rather than by enterostomy tube.

Comment

From the history of rectal bleeding, rectal polyps apparently had been present since the patient was about three months of age. Doehring, Lockhart-Mummery,[5,6] Miller and Sweet, Wesson and Bargen, Mayo and Butsch, Brust and Rankin and co-workers have frequently emphasized that there is a tendency for rectal and colonic polyps, particularly of the diffuse type, to undergo malignant transformation. Single polyps display a definite inclination to become malignant. In 5 per cent of the cases of single polyps reviewed by Brust, definite carcinoma developed in the brief period of five years. Unmistakable evidence of early malignant transformation was found in a group of glands in the large polyp in the transverse colon of the patient whose history has just been given in detail.

The problem of postoperative intestinal obstruction is one which taxes the judgment of the surgeon to the utmost. Wangensteen and associates, in a recent article, have reiterated the indications and contraindications for the treatment of intestinal obstruction by suction. If one suspects that there is interference with the blood supply of any loop, immediate exploration is the outstanding indication regardless of the state of the patient. In the present case, the onset of distention was gradual, pain was not severe, there were no definite localizing signs, and because the obstruction was high in the small intestine, conservative treatment was employed. In this instance, nearly complete obstruction persisted from the sixth to the thirteenth postoperative days, and from the nineteenth to the twenty-fifth postoperative days. Regardless of the prolonged obstruction, the urea, chlorides and carbon dioxide combining power of the blood were maintained within nearly normal limits.

We corrected the tendency toward alkalosis and edema which occurred on the ninth day by the administration of ammonium chloride through the enterostomy tube. Deficiency in vitamins B_1 and C was prevented by administration of these substances intravenously. It has been shown through the work of Brinkhous, Smith and Warner, Quick, Dam, Snell, Butt and Osterberg that the presence of bile and a "Koagulation" factor in the intestinal tract are necessary for the formation of prothrombin. It is probable that prolonged starvation and loss of bile from the upper portion of the intestinal tract resulted in the absence of vitamin K from the intestinal tract and subsequent prothrombin deficiency in the case reported. We believe also that the multiple transfusions of fresh blood introduced sufficient prothrombin to tide the patient over temporarily until the enterostomy could be performed and surface for absorption could be made available.

Summary

A case of a boy, aged seven years, who had multiple polyps of the colon with malignant change in one of the lesions has been presented. The patient's postoperative course was complicated by intestinal obstruction and ultimately by rectal bleeding which ensued from prothrombin deficiency. With conservative treatment the chemical constitution of the patient's blood was maintained within nearly normal limits until the twenty-fifth postoperative day, in spite of persistent intestinal obstruction. An enterostomy of the Witzel type was sufficient to relieve the obstruction permanently. The rectal bleeding which developed on the twenty-fifth postoperative day on a basis of prothrombin deficiency was treated successfully by multiple transfusions of fresh blood and the administration of vitamin K and bile salts.

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ALLERGY IN GENERAL PRACTICE*

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SINCE various estimates[1,2] indicate that from 7 to 10 per cent of the total population exhibits some manifestation of the allergic state, the general practitioner of medicine must of necessity give an increasing amount of attention to this phase of medical practice. Discovery of the offending allergens, their elimination, or the use of specific desensitization can be accomplished by following certain practical methods, the cost of which is not excessive and the results good if one has the time and patience to investigate each case to the limits of its possibilities. The following discussion will include those methods which have been found practicable in discovering the causative agent or agents together with brief case reports to illustrate certain principles of investigation.

The factor of hypersensitivity must be considered in many illnesses. We well know its etiologic relationship in hay fever, allergic coryza, bronchial asthma, urticaria, angioneurotic edema and atopic eczema. There are definite proved instances of gastro-intestinal allergy, allergic migraine and bronchitis. Its importance in such conditions as "spastic colon," "mucous colitis," acne and other more obscure disorders is still largely a matter of romantic speculation.

Clinical Diagnosis

The symptoms in the average case are typical and easily recognized. The more obscure type of case needs to be more critically evaluated. It certainly is not rational to conclude that because a given patient's symptoms are obscure they must be "allergic." In a given doubtful case one or more of the following criteria should be present in order to merit an allergic investigation:

1. Presenting symptoms or objective findings which definitely suggest an allergic state and which can be explained on the basis of smooth muscle spasm or by increased capillary permeability.

*From the Winona Clinic. Read at the annual meeting of the Southern Minnesota Medical Association, New Ulm, Minnesota, September 18, 1939.

2. The occurrence of one or several other manifestations of allergy.
3. A positive family history.
4. The presence of a blood eosinophilia.

History

The value of a careful and detailed history could hardly be overstated. It is equal in value to the more spectacular skin tests. It will frequently indicate contacts and suggest relationships which, when investigated, lead the way to the agent or agents responsible for the patient's symptoms. This is the place where one can do his good work in an obscure case of bronchial asthma. It costs nothing except time. One to several hours of questioning, recording, and study of significant data are required. The history alone, if complete and detailed, coupled with elimination of suspected offenders, will solve many a problem without the use of extensive cutaneous testing. The following case will illustrate this point:

Case 1.—J. M., aged twenty-one, was seen on August 22 with a severe attack of bronchial asthma which required adrenalin for relief. He complained of wheezing and difficulty in breathing, which had recurred with increasing severity during the past month. He had had no previous attacks. Because of the date of onset of symptoms, pollen sensitivity was, of course, suspected. On further questioning it was found that he was employed in the tablet department of a local patent medicine concern for the past six months and that during the past week he had assisted in the manufacture of a tablet containing licorice root. No other changes in his environment could be elicited. A sample of licorice root was obtained and when he inhaled this a typical attack of asthma was produced. A shift to another department was followed by complete relief of symptoms.

The important part of the history resolves itself into the study of two things, closely related: (1) the individual attacks; and (2) a study of the environment and particularly the changes in environment and whether or not these changes are associated with corresponding changes in symptoms.

The Attacks.—Rackemann[3] has stressed the importance of a careful study of the individual attacks, noting the exact dates of onset and cessation of symptoms beginning with the very first attack and following through each subsequent one, noting all associated changes in environment and possible causative factors. Symptoms that have a definite seasonal incidence corresponding to dates during which certain pollens are prevalent are obviously due to this factor. Hay fever and asthma occurring only in April are probably from trees, in May or June from grasses, in August and September from ragweed. In the winter months they are likely to be due to dusts, feathers, mattress or the like. Urticaria in June or July is probably from some seasonal food. The time of day in which most attacks begin is important. The person who is entirely free from asthma except at night or when he lies down in the afternoon is probably sensitive to some part of his bedding (feather pillow, mattress dust, wool blankets, et cetera). The person who has headaches after Sunday dinner and at no other time probably is sensitive to some favorite dish which he seldom has at any other time. The individual who has abdominal pain and a loose stool after breakfast frequently, and rarely at other times, probably has an intolerance for eggs, coffee or some other breakfast food.

The Environment.—Inquiry into the patient's occupation, its hazards, and especially the dusts or fumes connected with it may lead to the discovery of the cause of trouble. The residence is important. Farm houses have dusts from animals, hay, grain, fertilizers and insecticides which may be quite different from the dusts of cities. Changes in residence, occupation or place of work and the effect on symptoms or the lack of effect, often furnish an important lead.

Case 2.—The following case is that of a young woman, aged 25, a beauty parlor operator, who complained of watering and itching of her eyes, swelling about the eyes, stuffy, "runny" nose and frequent sneezing intermittently for two years. Symptoms occurred at home as well as at work but were more severe while at work and most marked when cutting and combing hair. She had worked at Marshfield for four months during this period and while in Marshfield she was free of symptoms. A study of the various types of preparations used in her work showed that she had used at home a wave set containing gum karaya which had not been used while at Marshfield. A sample of gum karaya powder when inhaled caused a typical severe "hay fever." Elimination of this wave set was followed by complete cessation of symptoms.

Hospital admissions are of great value. Not only does the patient escape from his home but he lands in an environment in which experience has shown that almost all the extrinsic cases of

asthma become symptom-free within a period of five days. When a patient has always lived at home with no change of any kind a study of the history is difficult chiefly because of the absence of history. In such an instance he can be moved away from home and the effect of the change observed.

General Physical and Laboratory Study

Complete physical and laboratory studies are of course, essential. The appearance of the mucous membrane of the nose in allergic coryza is frequently very characteristic: this appears pale, edematous and some thin watery secretion can often be seen. A smear of the nasal secretion shows a predominance (ten per cent or more) of eosinophiles. Leukopenic index studies are of doubtful value in the study of any allergy.

Cutaneous Tests

The elaborate set-ups for skin testing utilized in the large allergy clinics are, of course, financially impracticable in the average office. However, one should have, in addition to pollen extracts, an assortment of at least 100 test materials including all the known "common offenders" and one should be prepared to do both scratch and intradermal testing. Scratch tests are always used in testing for pollens and also for inhalants and foods in highly sensitive individuals. In testing infants and small children the pressure puncture method as advocated by Stoesser[4] is the method of choice. Intradermal testing is used in all other cases and will frequently show sensitivities not demonstrated by other methods.

Elimination and Trial Diets

In a suspected food allergy, when skin tests are negative or when symptoms are not controlled by diets which exclude foods to which skin reactions have occurred, "elimination" or "trial" diets as advocated by Rowe[5] and Vaughan[6] are indicated and are of decided value in localizing these offenders.

Modified Trial Diet

The following initial diet, which consists of foods least likely to cause distress, may be used for a period of five days:

Soup: Lamb or mutton broth, containing rice if desired.

Meat: Lamb or mutton, roasted or served in the form of stew or chops; lamb patties or hash; cold sliced lamb; casserole of lamb and rice; lamb and rice croquettes.

Cereal: Rice krispies, puffed rice, rice flakes, rice flour, boiled rice; pear juice or butter may be added.

Fruit: Pears, preferably baked with granulated sugar, pear juice, canned pears, stewed pears, or fresh pears without skin and seeds.

Sugar: Granulated or powdered only.

Fat: Butter or lamb fat only.

Seasoning: Salt only.

Beverage: Clear tea or water.

Suggestion.—For breakfast you may eat a lamb chop with puffed rice, rice flakes or steamed rice with butter or sugar, or some of the syrup from a can of pears. Cooked rice may be made into little cakes, and fried lamb, again with rice and canned pears. No coffee, sodas, fountain drinks or candy should be taken, and even chewing gum should be avoided.

After the fifth day add new foods once every fourth to seventh day in the following order: beef, potato, gelatin, carrots, turnips, asparagus, string beans, arrowroot cookies, rye crisp, thin toast, and oatmeal.

Environmental Control

This consists essentially in making the environment in which the patient lives and sleeps as completely dust-free as possible. All sources of inhalant allergens are eliminated. This procedure may be used for diagnosis and for treatment. Rowe[5] gives the following instructions for the preparation of a dust-free room:

Instructions for the Preparation of a Dust-Free Room

1. Your room should contain only one bed, preferably an iron one. If there is more than one bed in the room, it, too, must be prepared as will be described.

2. All the furniture, rugs, curtains, and drapes must be taken from the room, the clothes closets emptied and the room cleaned as follows:

a. Seal all the furnace pipes leading into the room. Clean the wallpaper. Scrub the woodwork and the floors in the room and closets. Wax the floors. Washable scatter rugs may be used.

b. Scrub the bed. Scrub the springs. This must be done outside the cleaned room. If you use a box spring, it must be completely encased as will be described. Cover the mattress, pillows and box springs with dust-proof encasings (covers). The covers must be made of material which is not porous, is allergen-proof. These encasings must be sewed on or otherwise closed up so they are completely air-tight. This must be done outside the cleaned room.

Now set up the bed in the cleaned room, and on it place the cleaned or encased pillows and freshly washed

bedding. All bedding must be made of material which will stand frequent washing. No quilts or comforters should be used.

c. Wooden chairs which have been scrubbed may be used in this room. Rag rugs washed at least once a week may be used on the floor. Plain light curtains washed once a week may be used on the windows.

d. This room must be cleaned thoroughly once a week.

3. You must sleep in this room. All dressing and undressing must be done elsewhere in the house.

Articles of furniture which contain allergenic dusts should be removed from the house, especially from adjoining halls and rooms, if possible. Otherwise each article should be vacuum cleaned thoroughly every day at a time when the patient is away from the house. Following the vacuum cleaning the house should be aired thoroughly.

This is especially valuable in the control of so-called house dust sensitivity. House dust sensitivity is essentially a composite sensitivity. This substance originates primarily from deterioration of furniture stuffing and mattresses. It frequently can not be broken down into other more specific sensitivities and must be considered and treated as an entity.

Case 3.—R.D., a male, aged twenty-eight, gave a history of recurrent asthma since the age of eight, recurring during both summer and winter months and frequently disabling him for periods of from one to several days. Adrenalin was often required for relief. His symptoms were always worse during August and September. He stated that he usually felt well when he came home from work but his chest "tightened up" during the night and his wheezing was most marked on awakening in the morning. Scratch tests with the various pollens gave a marked positive reaction to ragweed. Intradermal testing showed a marked 4-plus reaction to house dust and a 3-plus to mattress excelsior. The remainder of the tests were negative. A program of "allergic cleanliness" was instituted in his bedroom and living room followed by relief of asthmatic symptoms and therefore this regime was continued. Pollen desensitization was begun the following year. He has had no recurrence of symptoms except for mild wheezing associated with upper respiratory infections on two occasions.

Case 4.—A boy, aged twelve, had had an asthma for three years recurring every August and duration several weeks. Symptoms were also severe during the winter months. Symptoms were worse when inside the house, when playing with cats, and when a certain brand of fly spray was used in the house. Some of his attacks had come on while playing in the barn. His mother stated that his asthma was always worse on a rainy day and that he had a habit of sleeping on an old couch on the front porch on rainy afternoons. Physical examination, laboratory study and radiographs of his chest were essentially negative. A series of scratch tests were negative.

Intradermal testing gave the following positive reactions:

House dust++++
Cow dander+
Dog hair+
Chicken feathers+
Mattress+
Peanuts+
Tomato+
Corn+

The following therapy was advised: (1) Environmental control; (2) advised to dispose of the above-mentioned mattress and to stay away from all the farm buildings except the house; (3) desensitization against ragweed.

This regime was carried out and there has been no recurrence of symptoms.

Specific Desensitization

The value of this method in hay fever is well known. It may also be accomplished in other inhalant allergies. In the majority of cases of food allergy it has not proved successful.

Summary

Rational investigation and control of allergic disorders is by no means a difficult procedure and can readily be carried out in the average office without excessive cost to the practitioner.

Investigation should be continued until every allergic factor has been found and controlled.

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HISTORY OF MEDICINE IN HENNEPIN COUNTY

BY A. S. HAMILTON, M.D.

(Continued from February issue)

Minneapolis Hospitals

(Continued)

REST HOSPITAL was established in 1894 at 2527 Second Avenue South, and was operated as a general hospital admitting both medical and surgical cases. Among those on the staff were Drs. J. W. Little, W. A. Jones, H. W. Jones, and J. W. Bell. It was so operated by trained nurses until 1931, at which time it was taken over by Drs. Arthur S. Hamilton and Hewitt B. Hannah for the care of nervous and mental cases exclusively.

The SWEDISH HOSPITAL was incorporated January 4, 1898, and opened for the reception of patients in the old Judge Cornell residence at 1419 Ninth Street South, with a capacity of twenty-five beds. The first year, 238 patients were cared for. The training school for nurses was opened in 1899, and in 1900 "The Swedish Hospital and Nurses' Institute," an auxiliary corporation, was formed which purchased ground and erected a new hospital at the corner of Tenth Avenue South and Eighth Street.

The first medical staff consisted of Drs. A. E. Anderson, O. A. Fliesburg, Alfred Lind, Joseph A. Prim, and C. J. Ringnell; but the following are included in a list from another source as those serving on the original staff: *Surgery*—Drs. C. J. Ringnell, A. Soderlind, U. G. Williams, C. M. Kistler; *Medicine*—Drs. C. J. Lind, S. P. Rees, J. M. Kistler, A. E. Anderson, Gilbert Seashore, B. Dearborn; *Eye and Ear:* Drs. H. McI. Morton and J. G. Ericson; *Nose and Throat:* Dr. E. H. Parker; *Diseases of Women and Children:* Drs. Alfred Lind, O. A. Olson, J. H. Rishmiller, A. E. Johnson, J. Frank Corbett.

The hospitals, medical societies and medical celebrities of the current century are too recent to include in the early history of Hennepin County Medicine. Nineteen hundred has been chosen as the fitting end of this volume. The events and personalities that have crowded upon each other in the space of a generation since the close of the century must have space for their dramatic chronicle in a later volume, for which, perhaps, the efficient secretaries of the present day are preparing more accurate and more accessible source-material, if not more picturesque.

The following is the list of officers of the Hennepin County Medical Society so far as I have been able to learn them. In most instances the names are taken from notices published in the papers at the time of the election, and a few are taken from directories, which have not been found a very satisfactory source:

1855—President, A. E. Ames
Vice President, C. L. Anderson
Secretary, Dr. Wheelock

1862—President, A. E. Ames
Secretary, R. H. Ward

1867—President, A. E. Ames
Secretary, N. B. Hill

1868—Presidents, A. E. Ames and N. B. Hill
Secretary, N. B. Hill

1869—President, A. E. Ames
Vice President, N. B. Hill
Secretary, W. F. Hitchcock
1870—President, A. E. Ames
Vice President, N. B. Hill
Secretary, Geo. H. Keith
1871—President, A. E. Ames
Vice President, N. B. Hill
Secretary, W. F. Hutchinson
1872—President, A. E. Ames
Vice President, N. B. Hill
Secretary, O. J. Evans
1873—President, A. E. Ames
Vice President, N. B. Hill
Secretary, O. J. Evans
1874—Presidents, A. E. Ames and Chas. Simpson
Vice President, Chas. Simpson
Secretary, C. C. Clarke
1875—President, C. G. Goodrich
Vice President, O. J. Evans
Secretary, A. S. Salisbury
1877-1878—President, Edwin Phillips
Vice President, J. W. Murray
Secretary, C. L. Wells
1878-1879—President, J. W. Murray
Vice President, A. H. Salisbury
Secretary, C. L. Wells
1879-1880—President, A. H. Lindley
Vice President, O. J. Evans
Secretary, C. L. Wells
1880-1881—President, O. J. Evans
Vice President, C. L. Wells
Secretary, A. C. Fairbairn
1881-1882—President, Chas. Simpson
Vice President, A. C. Fairbairn
Secretary, N. Spring
1883-1884—President, C. L. Wells
Vice President, R. J. Hill
Secretary, F. E. Towers
1884-1885—President, R. J. Hill
Vice President, F. E. Towers
Secretary, M. E. Woodling
1885-1886—President, Woodling or Salisbury
1888-1889—President, E. J. Brown
Vice President, W. J. Byrnes
Secretary, C. J. Spratt
1889-1890—President, W. J. Byrnes
Vice President, J. H. Stuart
Secretary, G. W. Bass
1890-1891—President, J. Harlan Stuart
Vice President, J. W. McDonald
Secretary, G. W. Bass
1891-1892—President, J. Harlan Stuart
Secretary, G. W. Bass
1892-1893—President, W. A. Hall
1893-1894—President, J. W. McDonald
Secretary, A. F. Irwin
1894-1895—President, C. G. Weston
Secretary, A. F. Irwin
1895-1896—President, W. A. Jones
1896-1897—President, J. Warren Little
Secretary, J. W. Dudley
1897-1898—President, J. C. Cockburn
Secretary, W. B. Pineo
1898-1899—President, L. A. Nippert
Vice President, R. E. Cutts
Secretary, F. A. Knights
1899-1900—President, H. B. Sweetser
Vice President, Knut Hoegh
Secretary, F. A. Knights
1900-1901—President, A. W. Abbott
Vice President, C. A. Erdman
Secretary, F. A. Knights
1901-1902—President, H. L. Staples
Vice President, F. C. Todd
Secretary, A. E. Benjamin
1902-1903—President, J. W. Bell
Vice President, F. C. Todd
Secretary, F. A. Knights
1904—President, C. H. Hunter
Vice President, W. E. Rochford
Secretary, F. A. Knights
1905—President, D. Owen Thomas
Vice President, A. B. Cates
Secretary, F. A. Knights
1906—President, F. C. Todd
Vice President, J. A. Crosby
Secretary, C. H. Bradley
1907—President, J. E. Moore
Vice President, A. T. Mann
Secretary, C. H. Bradley
1908—President, F. A. Knights
Vice President, J. G. Cross
Secretary, C. H. Bradley
1909—President, J. D. Simpson
Vice President, J. F. Corbett
Secretary, C. H. Bradley
1910—President, C. A. Donaldson
Vice President, C. A. Lapierre
Secretary, C. H. Bradley
1911—President, Thomas F. Quinby
Vice President, H. E. Cary
Secretary, C. H. Bradley
1912—President, C. H. Bradley
Vice President, J. H. Rishmiller
Secretary, E. J. Huenekens
1913—President, H. H. Kimball
Vice President, Geo. D. Haggard
Secretary, E. J. Huenekens
1914—President, C. A. McCollom
Vice President, Robert Williams
Secretaries, E. J. Huenekens and and C. N. Brooks
1915—President, R. E. Farr
Vice President, J. G. Cross
Secretary, S. R. Maxeiner
1916—President, J. G. Cross
Vice President, A. S. Hamilton
Secretary, S. R. Maxeiner
1917—President, A. S. Hamilton
Vice President, J. C. Litzenberg
Secretaries, S. R. Maxeiner, R. T. LaVake, and C. W. Pettit
1918—President, E. K. Green
Vice President, J. F. Corbett
Secretary, C. W. Pettit
1919—President, J. C. Litzenberg
Vice President, C. W. Watson
Secretary, C. W. Pettit
1920—President, J. Frank Corbett
Vice President, Angus Morrison
Secretary, C. W. Pettit
1921—President, Geo. Douglas Head
Vice President, John Butler
Secretary, R. T. LaVake
1922—President, A. E. Benjamin
Vice President, A. E. Hedback
Secy. Treas., R. T. LaVake
1923—President, Fred L. Adair
Vice President, C. B. Wright
Secy.-Treas., R. T. LaVake
1924—President, C. B. Wright
Vice President, J. M. Lajoie
Secy.-Treas., R. T. LaVake
1925—President, Emil S. Geist
Vice President, F. A. Erb
Secy.-Treas., R. T. LaVake
1926—President, F. A. Erb
Vice President, S. R. Maxeiner
Secy.-Treas., R. T. LaVake
1927—President, S. R. Maxeiner
Vice President, A. E. Hedback
Secy.-Treas., Erling W. Hansen

1928—President, A. E. Hedback
Vice President, E. L. Gardner
Secy.-Treas., Erling W. Hansen
1929—President, N. O. Pearce
Vice President, E. L. Gardner
Secy.-Treas., Erling W. Hansen
1930—President, E. L. Gardner
Vice President, S. H. Baxter
Secy.-Treas., Erling W. Hansen
1931—President, S. H. Baxter
Vice President, Moses Barron
Secy.-Treas., Erling W. Hansen
1931-1932—President, Moses Barron
Vice President, J. C. Michael
Secy.Treas., Erling W. Hansen
1932-1933—President, Erling W. Hansen
Vice President, C. A. Stewart
Secy.-Treas., O. J. Campbell
1933-1934—President, C. A. Stewart
Vice President, Martin Nordland
Secy.-Treas., O. J. Campbell
1934-1935—President, J. M. Hayes
Vice President, W. H. Aurand
Secy.-Treas., O. J. Campbell
1935-1936—President, R. R. Crarmer
Vice President, J. H. Simons
Secy.-Treas., O. J. Campbell

In the above list of presidents, names are lacking for 1876, 1882-1883, 1886-1887, and 1887-1888. To fill these vacancies we have the names of Dr. F. E. Towers and either Dr. Woodling or Dr. Salisbury, so that I am still lacking the names of at least two of the ex-presidents. The year 1902 marks the change in the election of president from the middle to the end of the year. On this account, Dr. J. W. Bell served as president all of the year 1903 and half of the year 1902.

Health Officers

The Minneapolis Board of Health was organized in 1867 upon the incorporation of the city. This first board, or Sanitary Committee as it was called, consisted of Drs. A. E. Ames, N. B. Hill and A. H. Lindley. The last named was designated as Health Officer.

Since 1889, this title was supplanted by that of Commissioner of Health according to the proceedings of the City Council.

In the Council proceedings of 1879-1880 the office of City Physician is first mentioned. Under an act of the legislature, passed April 21, 1891, the Board of Charities and Corrections was organized, which biennially appointed a city physician and delegated to him the duties of Superintendent of Hospitals.

In 1919, the Board of Charities and Corrections was superseded by the Board of Public Welfare by act of the legislature. But in 1913, a civil service commission was organized in Minneapolis which provided that all of the employees of the Board of Public Welfare, except the Commissioner of Health, be subject to suspension or dismissal only by the Civil Service Commission. The dual position of city physician and superintendent of hospitals was continuous then under civil service, until the organization of the Board of Public Welfare in 1919. According to the charter provision arising out of the act which established the Board of Public Welfare, the city physician must be a licensed practitioner of medicine in Minnesota. In case the superintendent of hospitals is not a duly licensed practitioner, a city physician must be appointed who qualifies as such.

1867-1868	Dr. A. H. Lindley	Health Officer
1869-1871	Dr. W. H. Leonard	Health Officer
1871-1872	Dr. W. H. Leonard	Health Officer
1872-1875	Dr. Charles Simpson	Health Officer
1875-1876	Dr. G. F. Townsend	Health Officer
1877-1878	Dr. A. A. Ames	Health Officer
1878-1879	Dr. O. J. Evans	Health Officer
1879-1880	Dr. A. H. Salisbury	Health Officer
1880-1881	Dr. O. J. Evans	Health Officer
	Dr. S. M. Spaulding	City Physician
1881-1882	Dr. A. H. Salisbury	Health Officer, City Physician
1882-1883	Dr. J. C. Cockburn	Health Officer, City Physician

1883-1884	Dr. J. C. Cockburn	Health Officer
	Dr. A. B. Cates	City Physician
1884-1885	Dr. T. F. Quinby	Health-Officer
	Dr. C. W. Drew	City Physician
1885-1886	Dr. T. F. Quinby	Health Officer
	Dr. S. H. Van Cleve	City Physician
1886-1887	Dr. T. F. Quinby	Health Officer
	Dr. S. H. Van Cleve	City Physician
1887-1888	Dr. Samuel S. Kilvington	Health Officer
	Dr. James H. Dunn	City Physician
1889	Dr. Samuel S. Kilvington	Commissioner of Health
1890	Dr. Samuel S. Kilvington	Commissioner of Health
	Dr. C. A. Chase	City Physician
1891	Dr. E. S. Kelley	Commissioner of Health
	Dr. C. A. Chase	City Physician
1892	Dr. E. S. Kelley	Commissioner of Health
	Dr. C. A. Chase	City Physician
1893	Dr. E. S. Kelley	Commissioner of Health
	Dr. C. G. Weston	City Physician
1894	Dr. E. S. Kelley	Commissioner of Health
	Dr. C. G. Weston	City Physician
1895	Dr. H. N. Avery	Commissioner of Health
	Dr. C. G. Weston	City Physician
1896	Dr. H. N. Avery	Commissioner of Health
	Dr. C. G. Weston	City Physician
1897	Dr. H. N. Avery	Commissioner of Health
	Dr. C. G. Weston	City Physician
1898	Dr. H. N. Avery and Dr. A. K. Norton	Commissioner of Health
	(Dr. Avery died suddenly at Forman, N. D., and Dr. Norton became Commissioner.)	
	Dr. C. G. Weston	City Physician
1899	Dr. A. K. Norton	Commissioner of Health
	Dr. W. J. Byrnes	City Physician
1900	Dr. A. K. Norton	Commissioner of Health
	Dr. W. J. Byrnes	City Physician
1901	Dr. P. M. Hall	Commissioner of Health
	Dr. Henry S. Nelson	City Physician
1902	Dr. P. M. Hall	Commissioner of Health
	Dr. Henry S. Nelson	City Physician
1903	Dr. P. M. Hall	Commissioner of Health
	Dr. George E. Ricker	City Physician and Supt. of City Hospital
1904	Dr. P. M. Hall	Commissioner of Health
	Dr. George E. Ricker	City Physician and Supt. of City Hospital
1905	Dr. P. M. Hall	Commissioner of Health
	Dr. E. H. Beckman	City Physician
1906	Dr. P. M. Hall	Commissioner of Health
	Dr. E. H. Beckman	City Physician
1907	Dr. P. M. Hall	Commissioner of Health
	Dr. Ole E. Linjer	City Physician
	(Died in office Dec. 11, 1907. Completed unexpired term of Dr. Beckman and a few months of his own. He had been Assistant City Physician.)	
1908	Dr. P. M. Hall	Commissioner of Health, City Physician
1909	Dr. P. M. Hall	Commissioner of Health
	Dr. Herbert O. Collins	City Physician
1910	Dr. P. M. Hall	Commissioner of Health
	Dr. Herbert O. Collins	City Physician
1911	Dr. P. M. Hall	Commissioner of Health
	Dr. Herbert O. Collins	City Physician
1912	Dr. P. M. Hall	Commissioner of Health
	Dr. Herbert O. Collins	City Physician
1913	Dr. C. E. Dutton	Commissioner of Health
	Dr. Herbert O. Collins	City Physician and Supt. of City Hospital

1914 Dr. C. E. Dutton.....Commissioner of Health
1915 Dr. C. E. Dutton.....Commissioner of Health
(Office vacated June 11, 1915.)
Dr. H. M. Guilford.....Acting Commissioner of Health
1916 Dr. H. M. Guilford.....Acting Commissioner of Health
1917 Dr. H. M. Guilford.....Commissioner of Health
(Elected Jan. 2, 1917, for ensuing term.)
1918 Dr. H. M. Guilford.....Commissioner of Health
1919 Dr. H. M. Guilford.....Commissioner of Health
(Dr. Guilford died. Maurice King was elected as his successor on Feb. 28, 1919.)
1920 Dr. F. E. Harrington.....Commissioner of Health
1921 Dr. F. E. Harrington.....Commissioner of Health
1922 Dr. F. E. Harrintgon.....Commissioner of Health
1923 Dr. F. E. Harrington.....Commissioner of Health
1924 Dr. F. E. Harrington.....Commissioner of Health
1925 Dr. F. E. Harrington.....Commissioner of Health
1926 Dr. F. E. Harrington.....Commissioner of Health
1927 Dr. F. E. Harrington.....Commissioner of Health
1928 Dr. F. E. Harrington.....Commissioner of Health
1929 Dr. F. E. Harrington.....Commissioner of Health
1931 Dr. F. E. Harrington.....Commissioner of Health
1932 Dr. F. E. Harrington.....Commissioner of Health
1933 Dr. F. E. Harrington.....Commissioner of Health
1934 Dr. F. E. Harrington.....Commissioner of Health
1935 Dr. F. E. Harrington.....Commissioner of Health
1936 Dr. F. E. Harrington.....Commissioner of Health

(For list of Superintendents of City Hospital (General Hospital), see under Hospitals.)

Coroners

The following physicians have served as coroners in Hennepin County since 1869, at which time David Morgan is reported as being appointed county coroner: David Morgan, Charles Blecken, O. P. Chilstrom, P. Nelson, A. C. Fairbairn, R. J. Hill, Frank E. Towers, Wm. J. Byrnes, W. P. Spring, George E. Dennis, Henry S. Nelson, U. G. Williams, J. M. Kistler, and Gilbert Seashore (the latter having now served as coroner for twenty-eight years).

(To be continued in April issue.)

President's Letter

MAN follows the path of least resistance. It is very easy to ride along contentedly until a sudden jolt arouses us from our lethargy. It required several law suits involving large amounts to arouse sufficient interest on the part of organized medicine to study systematically disease caused by industry. Possibly these verdicts have been excessive and some of them unwarranted. But the fact remains that they were awarded.

The largest verdicts have been in cases involving dust. Eminent physicians, specialists of national repute, have testified against each other in many of these cases as to whether the individual had tuberculosis or silicosis or both as a result of dust.

Various other diseases, including lung diseases of different kinds, syphilis, kidney disease, dermatoses, and even appendicitis, have been declared by the courts to be compensable diseases.

This has resulted in intensified study on the part of organized medicine. The American Medical Association formed a new department in 1937 called the Council on Industrial Health. This Council held its second annual Congress on Industrial Health in Chicago last month, Northwestern Medical University formed a Department of Industrial Medicine in 1936, which is supported jointly by a group of industries and the University. This department held its third annual Symposium on Industrial Medicine in September. Other medical schools are following suit. At these meetings papers were presented by very able men on disabilities caused by such hazards as dust, welding, heat, and electricity, as well as various diseases which may be caused or aggravated by work in various lines of industry.

In Wisconsin the Industrial Commission is urging industry to institute periodic examinations of all employees. In all this organized labor seems to coöperate. The International Harvester Company has required an annual examination of every employee for many years and in addition a chest film every third year. This includes workers in their group of mines on the Mesaba Range. Many of the other mining companies are now doing the same.

At the second Annual Congress of Industrial Health last month, a paper was read by Terry C. Foster, U. S. Office of Education, Washington, D. C., on Rehabilitation in Relation to Medical Practice and Workman's Compensation Procedure which indicates the new trend of thought. The tendency in the past has been to care for a badly injured man, restore him to the best possible condition, testify for him before the compensation board, and then drop him. But this program is no longer considered sufficient. Means should be developed whereby the physician may be the advisor to some rehabilitation group which will train the crippled individual. If possible, he should be returned to his usual occupation. If that is impossible, he should be given training along some line of work that he can do so that he may become wholly or at least partly self-supporting. Then the physician, the rehabilitation group and the Compensation Board working together can more equitably estimate the disability.

A new committee has been formed in our State Association to study and investigate these problems, to learn what is being done elsewhere, and to make suggestions and advise procedure to be followed. It is called the committee on Industrial Hygiene and Occupational Disease. This is a large subject and a most important and timely one.

BERTRAM S. ADAMS, M.D., President
Minnesota State Medical Association.

EDITORIAL

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BUSINESS MANAGER
J. R. BRUCE

Volume 23 MARCH, 1940 Number 3

MORTALITY TRENDS IN 1939

THE mortality experience of the Metropolitan Life Insurance Company, paralleling as it does that of the country as a whole, is each year most interesting. The report of this company in its bulletin for January, 1940, indicates the trend of national health in 1939, and also during the past decade.

The health of the country apparently continued during 1939 at a high level, although the mortality rate may prove to have been slightly higher in the general population than the all-time low rate of 1938.

The marvelous advances in the feeding and care of infants in recent years have in large measure accounted for the great increase in life expectancy in our population. The continued decrease in mortality from the contagious diseases has further increased the life expectancy to the present high record of sixty-two years. While vaccination can be given some credit for the continuous reduction in diphtheria, other unknown factors account for the decrease in other contagious diseases.

Publicity campaigns probably should be given some credit for the continuous reduction in infant and maternal mortality. Certainly the concerted efforts directed to combat tuberculosis deserve the credit for halving the mortality from this disease in the past ten years and for cutting it to one-fifth of that in 1911.

One of the outstanding accomplishments in 1939 was the marked reduction (15 per cent) in the mortality rate from pneumonia in spite of an increase in mortality from influenza. It is safe to predict that the new dye therapy will show a marked further improvement in this regard unless the savings in lobar pneumonia are offset by an influenza epidemic.

It is yearly astonishing to learn that deaths from accidents of all kinds continue to decline. The high toll from automobile accidents each year is tremendous and impresses itself on our minds. Even automobile deaths in 1939, however, were slightly lower than in 1938 and the lowest since 1926, in spite of increased automobile traffic. The great saving in deaths from all accidents has been in industry, and has been so great that the number of fatal accidents has actually decreased in recent years.

The lowered birth rate and restriction of immigration in recent years and the increase in life expectancy have all resulted in a higher percentage of the population being in the latter decades of life. Thus the mortality from diseases incident to the later years of life—cancer, heart disease and diabetes—have naturally shown an increase in 1939 as well as in previous years.

The increase of 30 per cent in cancer mortality in the last ten years may not be actually as great when the improved methods of diagnosis of internal cancer are considered. This is a disease, however, which requires concentrated effort in order to attain earlier detection when cure is possible. Deaths due to coronary artery disease last year were nine times those so diagnosed ten years ago. Allowing for the possibility that the profession may be coronary-minded and may be over-diagnosing the disease, the actual increase in incidence of this disease and its appearance so frequently in the fourth and fifth decades is cause for alarm. It seems paradoxical that with the marked improvement in the treatment of diabetes the mortality has continued to increase in recent years with the exception of 1938, when there was a slight decline. Although treated diabetics live longer, the mortality rate for this disease is still increasing. Not only is the disease more often detected but the incidence of the disease has definitely been on the increase. This must be related to the high per capita sugar consumption in this country.

Of interest, too, is the drop of 20 per cent last year in the mortality attributed to alcoholism. The fact that the death rate was one-third of that ten years ago suggests that the American public is developing a little more sanity in its use of alcohol.

The improvement in the general health of the American people as reflected by the decrease in mortality is due to many factors. Practicing physicians should not forget the important part played by the sanitary engineer in providing clean water supply. Deaths from typhoid fever have been reduced to less than one per 100,000 population. Public health activities and a more health-minded public also account to some extent for the improvement.

CORONARY OCCLUSION AND THROMBOSIS

IN 1912, Herrick first called attention to the syndrome of coronary thrombosis. A full ten years elapsed before the diagnosis came to be commonly made.

The typical syndrome consists of the sudden onset of precordial pain or distress lasting several hours with a fall in blood pressure, pallor and cold perspiration and the development of an elevation of temperature, a leukocytosis and at times a pericardial friction rub. Changes in the electro-cardiogram confirm this diagnosis.

Such a typical picture is not difficult to diagnose, but the atypical case may prove disconcerting. There may be vomiting and epigastric location of the pain, or the pain may not be severe and the blood pressure may not be low.

The interpretation of cardiac pain in terms of the pathologic process in the heart and particularly in the coronary vessels is important to every physician. The cause of angina pectoris is now recognized as being an anoxemia of the heart muscle. When this lasts a few minutes it is due to a temporary lack of sufficient oxygen for the needs of the heart muscle at that time and is generally due to an arteriosclerotic narrowing of one or more coronary vessels. Prolonged duration of the pain is likewise due to anoxemia of the heart muscle and the cause is usually a thrombosis or an occlusion in a coronary vessel.

The terms coronary thrombosis and coronary occlusion are commonly used interchangeably. That the two processes are not identical is clearly shown in a recent article by Blumgart, Schlesinger and Davis.* These authors selected all cases in which there was clinical or necropsy evidence of heart disease in a consecutive series of autopsies. The coronary vessels were injected with a colored radio opaque solution, x-rayed and then dissected. The simultaneous injection of colored material gave information as to regions supplied by right and left coronary arteries or both.

In brief, these authors showed that in the presence of coronary arteriosclerosis with narrowing of the vessels collateral circulation is established between the right and left coronary arteries where it is needed. Whether these connecting arteries are newly formed or are enlargement of already existing minute vessels known to be present normally is not known. One of the startling facts which they have proved is the existence of coronary occlusion in not only one but, at times, in two or three main coronary branches in many cases in which there was no clinical history of symptoms of coronary thrombosis or even angina pectoris. The previous development of collateral vessels is given as the explanation for the ab-

*Blumgart, Herman L., Schlesinger, Monroe J., and Davis, David: studies on the relation of the clinical manifestations of angina pectoris, coronary thrombosis and myocardial infarction to the pathological finding. Am. Heart Jour., 19:1, (Jan.) 1940.

sence of symptoms. Just as startling is the absence of old infarcts in these cases and this absence is explained also by the presence of collateral vessels.

There is, then, a distinction between coronary occlusion and coronary thrombosis. The former may occur without producing symptoms of heart pain because of the presence of newly developed collateral circulation. Such circulatory change does reduce the blood supply to the heart muscle and angina pectoris may be present if oxygen supply to the muscle is not sufficient to meet the demand. The picture of prolonged heart pain, pallor, lowered blood pressure, leukocytosis and fever should be diagnosed coronary thrombosis and indicates the formation of an infarct of the heart muscle. These patients require at least six weeks of absolute rest.

MEDICAL LITERATURE

IN the Lloyd Roberts lecture with the above title delivered before the Medical Society of London on November 16, 1939 (*The Lancet*, 2: 21, 1939), Sir Robert Hutchison, President of the Royal College of Physicians, discusses in detail the bulk of medical literature in the world, its quality and how to cope with the enormous surfeit of it which he takes pains to show really exists. In his analysis of the periodical situation he quotes freely from the Schorstein Memorial lecture on "Medical Periodical Literature" by Professor William Bulloch, F.R.S. (*British Medical Journal* 2:810, 1935), stressing particularly the latter's estimate that there are over 5,000 medical periodicals of one sort or another in the world, while others, he states, have put the number as high as 7,000. Put in another way, states Professor Bulloch, "there have been, on an average, two articles published on tuberculosis alone *every day* for the last forty years."

Inferentially the blame for this situation is placed at the door of the United States, for it is stated in the Hutchison lecture that Great Britain produces about 130 medical journals and everyone knows that the output of the other European countries is not large. But an examination of the 1938 A.M.A. Directory shows that in this country, including the Philippine Islands, Puerto Rico and Canada, there are but 224 medical journals altogether. Where, then, are the other thousands? The answer is to be found in the Bulloch lecture where, in an attempt at facetiousness, the well known pathologist gave the names of some, such as the "Doctor's Factotum." Evidently every trade organ in this country has been included in the term "medical periodicals of one sort or another" and this, to us, is patently ridiculous. Regrettably it weakens the argument but it does not alter the fact that nevertheless there is plenty of room for improvement in the field of regular medical literature everywhere, both in the periodicals and in the books. The rest of the Hutchison lecture contains some very valuable discussion of the weaknesses which still infest both fields and makes a number of useful suggestions. It is unfortunate that it is marred by the irrelevancies and inaccuracies which have been pointed out.

GILBERT COTTAM.

ECONOMIC QUESTIONS

BEING doctors and not political economists, here are a few questions we should like to have answered.

Why do wealthy citizens establish Foundations, the activities of which are largely devoted to the establishment of socialism in medicine?

Why do certain individuals who have prospered by reason of their own industry and initiative become parlor socialists and even communists, ignoring the fundamental biological necessity so tersely stated in the phrase "Root, hog, or die"?

Can human nature resist the temptation to spend money in riotous living and to ignore the virtue of saving if there is assurance that thrifty neighbors through taxes will furnish support in later years of poverty?

Is there any reason why the medical profession should be socialized and not lawyers and merchants?

Why do certain advocates believe that a governmental bureau with a large personnel and a lot of red tape can supply medical care to our citizens without an enormous increase in total cost?

Why do the same individuals believe that in a panel system patients will receive the same individual medical attention as they now do?

What country with any form of government sickness insurance has better health and a lower death rate than the United States?

What in case of free medical service is to prevent neurotics from making life intolerable for salaried government physicians by reason of needless day and night calls?

What reason is there to believe that there would be a common objective for the worker relating his subjective symptoms for the purpose of obtaining certification for sickness benefit, and for the doctor whose object is to cure the worker?

Why does our government continue to buy gold at a pegged price when gold is no longer a medium of national or international exchange?

Why does our government continue to buy silver at a pegged price when it is considered the height of folly for an individual to pay more for anything than is necessary?

Why does our government deliberately favor higher wages and thus higher cost of production, which everyone knows necessitates a lowering of consumption of goods, a higher tariff and less foreign trade?

Why do some believe that the economic law of supply and demand can be circumvented by legislation?

OF GENERAL INTEREST

Dr. Max Kern of Rogers, Minnesota, son of Dr. M. J. Kern of Saint Paul, has moved to Freeport, Minnesota.

* * *

Dr. William J. Noonan has opened an office at 515 Medical Arts Building, Minneapolis, for the practice of urology.

* * *

Dr. H. T. Sherman, formerly of Mantorville, has moved to Nerstrand, Minnesota, taking over the practice left open last October when Dr. R. Wilkowske moved to Owatonna.

* * *

Dr. Robert Maves, who has been associated with Dr. F. C. Westerman in Montgomery, has purchased a practice in Burien City, Washington, and will follow his profession in that city.

* * *

Dr. Lloyd Gilman, who has been practicing medicine at Osceola, Wisconsin, has moved to Atwater, Minnesota, where he will share offices with his brother, Dr. Donald Gilman, who is a denfist.

Dr. C. L. Farabaugh, who has had his practice in Owatonna since 1931, has announced the opening of offices at 3657 Emerson Avenue North, Minneapolis. He will specialize in treatment of diseases of the eye.

* * *

Dr. C. B. Abbott, Springfield, Minnesota, is in Mexico City, recuperating from a cholecystectomy. He expects to return to his practice in Springfield the latter part of March.

* * *

Dr. David Schuele, who has been associated with the Gamble Clinic of Albert Lea for more than two years, is now located in Chatfield, Minnesota. He will be associated in practice with Dr. Charles Wodruff, who has been practicing in Chatfield for thirty-nine years.

* * *

Dr. A. C. Strachauer has been named chief of staff of Eitel Hospital for 1940, succeeding Dr. J. C. Litzenberg. Dr. Walter Ude succeeds Dr. E. A. Bedford as assistant chief of staff and Dr. Theodore Stebbins succeeds Dr. U. S. Anderson as secretary.

* * *

Dr. Edward D. Churchill, John Homans professor of surgery at Harvard Medical School, will deliver the seventh E. Starr Judd Lecture at the University of Minnesota, March 14, 1940. His subject will be "Surgery of the Lungs."

* * *

The Foundation Prize of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons of $150 is again open to internes or those practicing this specialty. Manuscripts are due by June 1, 1940. For further information, address Dr. James R. Bloss, Secretary, 418 Eleventh Street, Huntington, West Virginia.

* * *

Dr. Arthur E. Karlstrom has been appointed director of hygiene and health education in the Minneapolis public schools. Dr. Malvin J. Nydahl, whom Dr. Karlstrom succeeds, has accepted appointment as head of the crippled children's bureau of the state social security department. Dr. Karlstrom, a graduate of the University of Minnesota Medical School in 1935, served as director of the public schools' child study department for a year and one-half after internship at the University Hospital and a teaching fellowship at Strong Memorial Hospital in Rochester, N. Y. He also has been clinical instructor of the university pediatrics department and a member of General hospital staff.

The Finnish Relief Fund

Physicians are urged to make any contributions they can to the Finnish Relief Fund sponsored by Mr. Herbert Hoover, and to be devoted to supplying the Finnish civilian population with food and clothing. The need is great. Even small contributions will be gratefully received. All checks should be made payable to the Finnish Relief Fund, Inc., and sent to the Medical Division of the Fund, 420 Lexington Avenue, New York City.

MEDICAL ECONOMICS

Edited by the Committee on Medical Economics
of the
Minnesota State Medical Association
W. F. Braasch, M.D., Chairman

REPORT OF THE SURVEY OF MEDICAL CARE

The report of the Survey of Medical Care in the United States which has been compiled by the Bureau of Medical Economics of the American Medical Association has just been published. It includes reports from thirty-eight constituent state medical societies and 623 of the component county medical societies. Replies were received from 22,397 physicians and dentists. Of this number 17,000 were returned by physicians, who constitute 27 per cent of the physicians in active practice in the areas surveyed.

This survey covered a total population of 49,278,083 and is more fully representative of both urban and rural populations than any previous similar investigation. The survey was not devised primarily to produce a statistical report, but rather to obtain a consensus of opinion after a study of the facts by those close to the situation as to the need and supply of medical care.

Value Enhanced

The value of the report is enhanced by the cooperation received from a large number of allied agencies. Other than from physicians and dentists, replies were received from 16,290 sources. These include reports from the following allied organizations:

Hospitals—1,336
Nurses organizations—1,888
Health Departments—839
Welfare and Relief Agencies—1,896
Schools and colleges—3,853
Other organizations—1,963

The combined data turned in by these various agencies should give a fairly accurate idea as to the need and supply of medical care. Not alone is this information made available, but practical suggestions for the improvement of conditions found were made in many instances. Examination of the data reported and of the opinions expressed justifies the conclusion that there is no important section of the population of the United States that now fails to receive the medical care it *needs* and *desires*.

Care of Indigent Inadequate

It would seem that the greatest inadequacies exist in the indigent groups which are supposed to be looked after by government agencies. This is indeed a sad commentary on a situation which might be taken care of if the agencies involved were properly managed.

The report is quite contrary to the data on which the National Health Program is based. It is high time the public was brought to realize the fallacies and exaggerations embodied in the National Health Report.

Frank criticism of the conditions involving medical care in various localities and detailed suggestions for their improvement are made by many of the county societies. These are specific, constructive criticisms as to defects for which a remedy is available and a program for future improvement is included in many instances. The following statements are quoted from the Report of the Survey:

Program Is Diverse

"The picture that takes shape out of all these details of facts and opinions appears to be one of a fairly well correlated and constantly improving program of medical care. This program has not been planned in detail and then applied by authority, but has grown and developed with infinite diversity to correspond to an infinite variety of local and historical differences. This program has been constantly expanded by the inclusion of new elements and the assumption of new tasks. Its organization is flexible and coöperative rather than fixed and authoritative. It includes a multitude of public and private organizations which, in spite of occasional disagreements and friction, in the majority of localities have agreed upon methods of coöperation and division of labor. It is free to experiment on any one of scores of fronts without involving an entire national movement in local

failures, while successful experiments are quickly and widely adopted.

Meets Pragmatic Test

"This program meets the practical, pragmatic test—it works. Measured by the statistical test that is applicable to any phase of medical care—that of morbidity and mortality—it has proved to be more efficient in attaining its purposes—to reduce illness and to postpone death—than any of the autocratic and official programs existing in other countries and which are urged for adoption here. The development of this program for the future depends upon the continuance of the same methods, constant investigation and study to discover defects, cautious experimentation with methods to correct those defects and development of such of these experiments as prove sound, practical and serviceable.

Foundation Laid

"This survey not only sought to bring out the facts concerning the need and supply of medical care, but to lay the foundation for whatever changes might be helpful in meeting any deficiency in the supply of medical care. County medical societies were asked to assemble the original forms and to analyse the facts which they revealed. It was suggested that medical societies should also assemble any additional information bearing on the subject of the survey and should then prepare a report, copies of which were to be sent to their respective state medical societies and to the American Medical Association. It was suggested that this report might well form the basis of proposed improvements in the local medical and health programs. Not all of the county medical societies carried out all of the details of this suggestion. A considerable number, however, did prepare such reports, some of them constituting fairly large bound volumes of typewritten or mimeographed material which contained suggestions as to the methods of introducing needed improvements.

Open to Examination

"The state medical societies also were asked to assemble the county society reports and to include a number of items of information applying to the state as a whole. Some of the state medical societies also prepared extensive bound volumes of the information assembled in the course of the study and the societies' recommendations as to future action. Many of the state and county medical society reports state that measures have already been taken to supply some of the deficiencies which the survey revealed. It is already evident that one of the results of the survey will be the introduction of appropriate improvements, some of them of a minor character and others of a more extensive nature requiring changes in the general program of medical care. Furthermore, the material assembled in this survey is available for the development of future programs. This material is open for examination by any public or private body or individual interested in improving the conditions of medical care in this country."

Will They Take Heed?

Now that these invaluable data are available for investigation by everyone interested, one wonders whether the federal authorities will take advantage of the opportunity which has been offered to them by the American Medical Association. Federal health authorities are given an opportunity in this Report to determine health conditions as they actually exist in the various localities, the deficiencies are clearly described and suggestions are made as to how to best correct them. One hesitates to make any prediction, but if government officials run true to form, the chances are that they will pay little or no attention to this invaluable survey.

Copies of the survey report are available to anyone applying to the office of our Association Secretary. Anyone who makes a careful study of its contents will be amply repaid. The Bureau of Medical Economics of the American Medical Association, under the able guidance of Dr. R. G. Leland, deserves the greatest praise for bringing its efforts to such a successful conclusion.

If the survey does nothing else, it brings out in bold relief the value of paragraph No. 5 of the platform of the American Medical Association, which calls for "The extension of medical care for the indigent and the medically indigent with local determination of needs and local control of administration."—W.F.B.

THE NATIONAL PHYSICIANS' COMMITTEE

Organization of the National Physicians' Committee has gone on apace. Through the energetic efforts of the Executive Administrator, Mr. John M. Pratt, a number of pamphlets have been distributed to all of the physicians of the country, informing them as to the objectives of the Committee, with suggestions as to action which might be taken.

There is no question that the best form of propaganda regarding the activities of the medical profession and its influence on the nation's health today is by word of mouth. In other words, if each physician would take upon himself the duty of informing his patients and friends as to the facts involved, we should accomplish a large part of our objective. There is no form of publicity quite like direct personal propaganda.

It would be advisable for members of the National Committee in each locality to get together

and formulate some program so that they can appear on the program of community or other groups and give them the information that we desire to put across.

If there is any lack of ideas on this subject, information can be gained by a careful perusal of the various pamphlets entitled "The Achilles Heel of American Medicine," "Priceless Heritage" and "The Minute-Men of American Medicine," which have been put in the hands of nearly every physician. The success of this movement is up to every individual member.

If additional material is desired, a discussion of the various portions of the platform of the American Medical Association would be most appropriate and would furnish plenty of campaign material.

FROM THE NATIONAL CONFERENCE ON MEDICAL CARE

Minnesota's conference off-spring, the Northwest Regional Conference, became a full-fledged national meeting in Chicago, Sunday, February 11, and some sixteen Minnesota physicians were among the 225 representatives from twenty-four states who attended.

Group medical care, group hospitalization, public welfare programs, the general tax problem and federal aid to the states in the extension of health programs were chiefly discussed on the program because medical leaders everywhere are pre-occupied with these and related problems.

It is to be hoped that proceedings of the conference will be published in full. In the meantime, the following brief résumé may be of more than passing interest as an indication of the extent and liberalism of medical endeavor today.

Hospital Service Extended

In Missouri, for instance, group hospital service, on much the same pattern as our Minnesota Hospital Service association plan, is being extended to rural districts. Dr. Carl F. Vohs, St. Louis, outlined the service, declared that it was operating successfully in Missouri and said that rural contracts are being sold through Missouri Farm Bureaus.

In New York City group hospital service has had difficulties in the last year or two and is now being re-habilitated. The fault, according to Mr. David H. McA. Pyle of New York, was not in group hospitalization itself, but in the former policy of selling individual contracts. Many individual contracts had to be canceled to set the plan on its feet again. Hospitals are coöperating to tide the plan over the rehabilitation period.

Michigan—Off to a Start

In Michigan, the new Michigan Medical Service is just getting off to a good start, according to Dr. Henry R. Carstens of Detroit. The service went on sale on January 1, 1940, and no figures are available, yet, to indicate how popular the service will be. It is now being tied up with a state plan for group hospitalization and is already taken on, according to Dr. Carstens, by some one of the biggest of Michigan's big industrial plants.

Farm Security Plans

Dr. R. C. Williams of the United States Public Health Service, reported that no less than 420 county medical societies are now coöperating with the Farm Security Administration to provide medical care for Farm Security clients in many parts of the United States. Details of the plans differ in different localities but all operate on the principle that the client will pay his doctor with money loaned to him by the administration and that the doctor will adjust his charges to the ability of the client to pay.

Choice in Chicago

In Chicago the right of relief clients to their choice of physician has been preserved and protected—in contrast to the situation in many other large cities of the United States, according to Dr. C. H. Phifer. Committees which are, in most respects, comparable to our County Contact Committees pass upon fees, settle differences. Of course, Cook county hospital and other public clinics are used.

Pitfalls

Dr. R. G. Leland warned of several pitfalls that may lie in wait for unwary states which accept Federal funds to set up programs otherwise entirely beyond the ability of the states alone to support. One of them lies in the unreliability of Federal funds which depend upon appropriations from Congress. If Federal funds are withdrawn, it will be up to over-burdened state legislatures to supply the funds.

Relief in Minnesota

Minnesota's re-organized relief program was outlined to the conference by Dr. A. W. Adson,

of Rochester, chairman of the Medical Advisory Committee to the Division of Social Welfare. For many years the handling of medical relief has been more satisfactory in Minnesota than in many other states. A ground-work of coöperation between doctors and welfare officials has been laid which will be utilized to the advantage of both in the official new system of county contact and advisory committees. These committees act in advisory capacity to county welfare boards with the state committee acting in a similar capacity to the state division and also as an appeal body from the county organizations.

The President Listened

President Roosevelt listened carefully to what doctors and hospital representatives had to say at the recent conference on the proposed new hospital building program, Dr. E. H. Cary of Dallas, chairman of the American Medical Association's Legislative Committee reported. This time he incorporated some of their suggestions in his message to Congress and, as a result, the bill introduced by Senator Wagner proposes that hospitals be provided on a basis of local need and not on a basis of matching funds, regardless of local needs. The National Health Program as previously drawn up is not dead, however, in the opinion of Dr. Cary. It may be revived at any time.

"If the Battle Is Lost"

Aid and comfort as well as good advice were to be found in a fine address by Mr. Paul G. Hoffman, president of the Studebaker Corporation. Said Mr. Hoffman:

"Industry faces much the same threat of socialization as medicine and industry, like medicine, must solve its own problems to protect itself from government interference. The tax problem underlies some of our difficulties. Taxes are increasing and must be curtailed before business can recover. We have leaders in Congress who are capable of handling the tax problem if left alone; but they must be given a chance.

"I admit to a fundamental recoil against socialized medicine. Bureaucratic control of medicine would, in my opinion, exert the same deadening influence in your profession that it has in the industrial field. But again, judging solely from what I have read, the problem is there and it has not been fully met. . . . With reduced national income and reduced individual income, in order to maintain automobile volume we had to bring down both the original cost and the upkeep of cars. Many millions of dollars were spent in market research on this problem. . . . I raise the question as to whether the medical profession has made a similar survey to find out what type of service the average person requires and what he can afford to pay for it. . . . I raise the question as to whether you have applied your fine professional brains to a challenge of every item of the cost of medication, including hospitalization, to make certain that you are giving the customer the best break you can for his dollar. These questions come to my mind because of my confidence that better answers can be found for them by private medicine than by socialized medicine. . . . If there is anything at all to the questions, I urge quick action because, if the battle for freedom is lost on the medical front, our fight to preserve free enterprise in business will be made that much tougher."

Complete Picture

The Connecticut Survey of Needs and Supply of Medical Care is being carried on, not by the medical association, but by the state government. Believing that a survey by physicians would be open to the charge of partiality, Connecticut doctors went to the governor, according to Dr. Creighton Barker of New Haven. Funds were appropriated and a study which it is hoped will give a complete picture of medical care in Connecticut was started. The survey is not yet completed.

Best Method

Many methods of reaching and educating the public were discussed by Dr. Edward J. McCormick of Toledo, but, the best method said Dr. Morris Fishbein, editor of the *Journal of the American Medical Association*, by way of comment, is still the direct approach of the physician himself to his patient and friends.

GROUP HOSPITALIZATION IN DULUTH

Seldom has any mutual health scheme taken hold of the Duluth public with such popular approval as has the hospital service plan.

In Canada and the United States four and a half million subscribers, according to figures submitted, are enrolled in non-profit hospital plans. Some groups have had hard sledding. Two states in the union have enrolled over 10 per cent of the population—New York and Minnesota. Forty-two per cent of the population of Duluth is enrolled directly or indirectly and this fact was the principle topic of discussion at the Mid-Winter Conference of Hospital Service Plans held in Pittsburgh in January, 1940.

The Duluth hospitals collected, on account of patients enrolled, $110,000.00 in 1939. This

amount was spent on about four thousand of the subscribers. The local office contributed its share to the half million reserve carried by the Minnesota Hospital Association. Ninety-eight per cent of these four thousand were in the hospital less than twenty-four days. Women used more of the service than men. The lower income group used the service less than the higher income group; the "whiter the collar" the more it was used.

A rough cross section of opinion among physicians was that their collections were not materially better as a result of the hospital plan. A few found some improvement.

The hospitals on the other hand were filled much of the time in 1939 and patients expressed enthusiasm for the scheme.

The Duluth office expressed its appreciation of the coöperation from local physicians. The average hospital stay in Duluth was less than that in the Twin Cities. To keep the cost to subscribers low means to keep the hospital stay short.—A.N.C.

PLAN TO LOWER COSTS—RAISE STANDARDS

An interesting new development in group health plans is the Group Health Federation of America, Inc., which has just completed its organization, adopted its constitution, by-laws and policies and elected officers.

This federation is composed of "voluntary group health plans in a coast to coast network," to quote a recent bulletin. Among them are the Ross Loos group of Los Angeles, the Group Health Association of Washington, D. C. (storm center of the District of Columbia controversy) and others.

According to its constitution and by-laws the federation aims to promote plans for providing good medical care to people of moderate means at a cost which they can afford and on a basis where they can pay their own way without resort to charity. The organization will "establish and maintain among its members high standards of personal medical care. It will also seek to unify and coördinate the activities of member groups and exchange experiences and information so that each may benefit from the knowledge gained by others.

"—To Complete the Work"

"In essence the Federation hopes, over a period of time, *to complete, in the field of group medicine, the work that has been done by the American Medical Association in raising standards of practice for the individual physician* (italics are ours).

Many names familiar for their association with the earlier promotions of the Foundations or as leaders of individual enterprises which have been much in the news appear among the officers and directors. They include as officers Dr. Mahlon D. Ogden, Trinity Hospital, Little Rock, Arkansas, president; Dr. Michael Shadid, Farmer's Union Coöperative Hospital Association, Elk City, Oklahoma, vice president; Charles A. Marlies, Group Health Association of New York, secretary-treasurer, and Martin W. Brown, assistant secretary. On the Board of Directors are Dr. A. L. Curtin, Milwaukee Medical Center, Milwaukee; Michael M. Davis, Committee on Research in Medical Economics, New York (formerly with the Rosenwald Fund); C. G. Garman, Group Health Association, Washington, D. C.; Mr. Marlies; Dr. M. D. Ogden, Trinity Hospital, Little Rock, Arkansas; Dr. Elmer Richaman, Wage-Earners Health Association, St. Louis, Mo.; Dr. Kingsley Roberts, Bureau of Cooperative Medicine, New York City; Dr. Shadid; Dr. Joseph Still, Greenbelt Health Association, Greenbelt, Maryland; Dr. C. R. Wiley, Civic Medical Center, Chicago.

GROSS MISDEMEANOR

Occasionally, recipients of Old Age Assistance see an opportunity for additional assistance in the allowance made for medical care.

To secure it, all they have to do is to get the doctor to declare they are in regular need of medical service. The doctor is not often a party to such maneuvers but now and again he may yield out of kindness of heart—and ignorance of the fact that he is committing a gross misdemeanor. The law on the matter is explicit. It reads as follows:

Laws of 1937
Section 21

Any person who has obtained or who, by means of a wilfully false statement or representation, or by impersonation, or other fraudulent device, hereafter obtains, or attempts to obtain, or aids or abets any person to obtain:

(a) An old age assistance certificate to which he is not entitled;

(b) More old age assistance than that to which he is justly entitled;

(c) Payment of any forfeited installment grant;

(d) Or who knowingly aids or abets any person buying or disposing of the property of the recipient with the intention to assist in receiving or qualifying any person for old age assistance;

(e) Or any recipient who transfers any personal property exceeding $300.00 in value without first giving notice to the County Agency of his intention to do so; shall be guilty of a gross misdemeanor.

HOSPITAL REPORT

In view of Senator Wagner's new bill for an emergency appropriation for hospital building, a brief review of the record of hospitals already built with Federal aid in the last six and one-half years should be of interest. These hospitals, it should be noted, do not include any veterans' hospital construction, Federal sanitariums, Indian or military projects or Federal prison infirmaries.

107,849 New Hospital Beds

A recent PWA report on this construction appears in the *Congressional Record* of January 30, 1940:

"During the past six and one-half years the Public Works Administration has made $176,928,556 in allotments for 743 hospital projects involving the construction of 2,056 buildings providing 107,849 beds. The total construction cost of this portion of the PWA program has been estimated at $297,253,706. They are located in all the states, the District of Columbia, Alaska, Hawaii and Puerto Rico and approximately 45 per cent of them are located in states that do not contain large metropolitan areas. Many of the hospitals were constructed in communities which heretofore had been without hospital facilities.

Five Years' Growth

"The technical committee appointed at the President's National Health Conference in 1938 determined that the normal increase in hospitals beds has been 25,000 a year. As a result of PWA construction there has been the equivalent of five years' normal growth during the six and one-half years covered.

"PWA-financed non-Federal hospitals are classified into general hospitals, those special hospitals needed in many sections of the country to bring the Nation's hospitals facilities to an adequate standard. The President's technical committee advised that 36,000 beds a year for ten years should be added to the existing supply to adequately meet the demand and in addition the setting up of some 500 health and diagnostic centers in areas now inaccessible to hospitals.

Applications Returned

"This nation-wide need for additional hospital facilities was indicated in the fact that when PWA returned 5,043 applications to public bodies on September 6 because of lack of additional funds there were among them 203 applications for hospitals and institutions with an estimated construction cost of $105,486,892."

New Beds in Minnesota

In Minnesota there were 21 hospital projects built providing 42 new buildings and 1,926 additional beds at a cost of $4,745,377. In Wisconsin there were 18 new hospital projects, providing 40 additional buildings and 1,074 beds at a cost of $3,925,980. In Iowa, there were 19 projects providing 18 new buildings and 855 beds at a cost of $1,900,834. The largest number of new hospital beds were provided with PWA aid in Illinois (10,582), in New York (9,721) and in Pennsylvania (8,516).

In addition to this vast amount of civilian hospital construction there have been 152 Federal hospital and sanitarium projects costing $37,002,863. These projects, including veterans' hospitals and sanitariums, Indian and military hospitals and Federal prison infirmaries, have added an additional 13,911 beds to the nation's hospital capacity, making a total with the non-Federal figure of 121,760 beds.

"WE CAUTION OUR READERS"

For those who were lulled into a false sense of security by the President's birthday message, an editorial which appeared in the last issue of the *Pittsburgh Medical Bulletin* is printed below in full. It is evident that the Wagner bill of 1940 is far from innocuous and the best thought and advice from medical and hospital authorities should be sought before an "experiment" of far reaching consequence is inadvertently fixed upon the statute books.

THE LONG TENTACLES OF BUREAUCRACY

In last week's Bulletin we promised to print in this issue the text of S. 3230, another bill introduced by the Prussian-born Senator Robert F. Wagner of New York. We cautioned our readers at the same time when reading the bill to measure its assertive provisions with their possible distortion through amendment or in subsequent actual administration with the seven guiding points previously proffered President Roosevelt by committees from the American Medical Association and the various national hospital associations.

It will be noted that the bill differs from President Roosevelt's recent message to Congress on the subject of his pet medical service project—the erection by the Federal government of approximately 50 small general hospitals in localities where the need for same has been established and evidence of ability to maintain

them by local funds has been demonstrated. For instance, the bill does not stop with the provision by the current session of Congress for 7½ to 10 million dollars for the construction of such hospitals, but in Section 2 opens wide the "pork barrel" through $10,000,000 for the year ending June 30, 1941, and for each fiscal year thereafter such sums as the Congress may deem necessary for carrying out the purposes of this act. Also, amounts appropriated under this bill shall be available until expended.

Section 9 opens up an unexpected avenue for the allocation of funds by the President through authorization for the appropriation in each succeeding fiscal year of such amounts as the Congress may deem essential for "the training of personnel deemed necessary" by the Public Health Service for administering the provisions of S. 3230. This at once suggests medical schools definitely under Federal control. In the face of recent commitments by the President of the American Public Health Association and by representatives of the U. S. Public Health Service at the former organization's 1939 meeting in Pittsburgh to the effect that public health activities should now be rapidly broadened with Federal funds in all the states to include more and more of the "curative" phases of medical practice, such angles to any proposed health legislation definitely lengthen the tentacles of bureaucracy.

That our readers may have authoritative bases from which to judge all proposed health legislation in discharging their public duty to discuss such proposals with other intelligent members of the community, i.e., with taxpayers, voters and legislators, we publish again in this issue the recent health legislative platform of the American Medical Association and the seven points governing specifically all proposed new governmental general hospital construction.

Individuals or organizations that see fit to ignore the dangers of advancing the current political philosophy new to the United States "national socialism," should still be cautioned when they engage in discussion of the advisability of seeking new or additional general hospital facilities for a community, a county, or a district, to become acquainted with certain local and fundamental facts: What is the population per square mile in the district? What is the existing general hospital bed capacity, as well as bed occupancy?

Finally, we repeat to our medical readers the caution expressed on page 94 of the Bulletin for February 3, 1940; namely, when new general hospital construction is under consideration, strive consistently, wherever and whenever they are to be located, for competency, free from political domination in expenditures and the professional "staffing" of government-built, locally supported general hospital projects; also, renew your vigilance regarding the future of any medical or social legislation to which the name of Senator Robert F. Wagner is attached, more especially in the face of the recently announced fact that President Roosevelt's Interdepartmental National Health Program Committee, under the chairmanship of Miss Josephine Roche, is "on the loose" again.

"YOUR INSURANCE POLICY"

(Monthly Editorial Prepared by the Medical Advisory Committee)

In a recent communication directed to the chairman of the Medical Advisory Committee was the following paragraph:

My contacts with the doctors the last few years have convinced me that the doctors themselves are their worst enemies and most of them are more or less indifferent to things of their own interest until something happens to affect their pocket book."

How often have you inspected or read your policy of malpractice coverage? Do you know the various provisions in the policies as to the amount involved should you be sued? Is your associate, your assistant or your partner covered by your protection?

These and many other questions could be asked of you, and the likelihood is that the reader would be astounded at his lack of knowledge of the fundamental facts in his policy.

Why not take your policy to the solicitor who wrote it and accepted your premium, or to your lawyer who can explain its provisions to you today, before you are involved in trouble.

In the worry and hustle of medical practice, we are inclined to minimize the possibility of need for adequate protection, but business is business, as many find to their sorrow. Surely, foresight is better than hindsight.—*B.J.B.*

MINNESOTA STATE BOARD OF MEDICAL EXAMINERS

Julian F. Dubois, M.D., Secretary

License of Minneapolis Physician Revoked Following Conviction for Manslaughter

In the Matter of the Revocation of the License of Richard J. C. Brown, M.B.

At the regular meeting of the Minnesota State Board of Medical Examiners held at Saint Paul, on February 9, 1940, the license to practice medicine held by Richard J. C. Brown, Negro physician of Minneapolis, was revoked. Brown was convicted by a jury of the crime of manslaughter in the first degree, in the Court of the Honorable Arthur W. Selover, Judge of the District Court of Hennepin County, on November 22, 1939. Brown was sentenced on November 25, 1939, by Judge Selover to a term of not less than five and not more than twenty years at hard labor in the State Prison at Stillwater. Brown had been indicted by the grand jury of Hennepin County on August 29, 1939, following the death of a 22-year-old Minneapolis girl upon whom it was alleged that a criminal abortion had been performed on July 31, 1939, by Brown.

According to the records of the Minnesota State Board of Medical Examiners, Brown was born at Lincoln, Nebraska, January 17, 1893, and graduated from the University of Minnesota, in 1920, with the degree of Bachelor of Medicine. He was licensed that year by examination.

Minneapolis Physician's License Suspended for Three Years

In the Matter of the Revocation of the License of Donald V. Jordan, M.D.

Donald V. Jordan, M.D., 39 years of age, with an office at 126 Oak Grove, Minneapolis, had his license to practice medicine suspended by the Minnesota State Board of Medical Examiners at its last regular meeting on February 9, 1940. The Medical Board had previously issued a citation requiring Dr. Jordan to show cause on that date, why his license as a physician should not be revoked for aiding and abetting a criminal abortion upon a 19-year-old unmarried Minneapolis girl. The girl was taken ill following the alleged abortion and was hospitalized. However, she recovered her health and subsequently made a statement concerning the case. The hearing before the Minnesota State Board of Medical Examiners disclosed that Dr. Jordan was an excessive user of alcoholic liquors and he was notified by the Medical Board to place himself under treatment for that condition.

According to the records of the Minnesota State Board of Medical Examiners, Dr. Jordan was born in Minneapolis on November 17, 1900, and graduated with the degree of Doctor of Medicine from the University of Illinois, in 1928. He was licensed in Minnesota in 1932, by reciprocity with the State of New York.

MEDICAL AND PUBLIC HEALTH EXHIBITS

The Medical and Public Health exhibits at the New York World's Fair, which were attended by 7,500,000 visitors in 1939, will be reopened for the 1940 season beginning May 11, as announced by Dr. Louis I. Dublin, Acting Chairman of the American Museum of Health.

New exhibits, the nature of which will be made public before the opening date, will be added to the Carrel-Lindbergh "heart," the Transparent Man and other dramatizations of medical science which vied last year with such industrial features as the General Motors Futurama and the American Telephone and Telegraph Company's "Voder" as drawing cards for Fair visitors.

The outstanding value of the Medical and Health exhibits in spreading a knowledge of hygiene among millions of persons is emphasized by Dr. Thomas Parran, Surgeon-General of the United States Public Health Service, in the following letter to Dr. Dublin:

"It is gratifying to learn that the continuation of the Medicine and Public Health Building at the New York World's Fair is assured for 1940 under the direction of the American Museum of Health.

"The unprecedented success of this undertaking last year should give you every confidence that the Museum will continue its high service to mankind.

"The studies of Visitor Reaction in which the Public Health Service coöperated with you clearly show that the exhibit gave to several million people from the United States, Canada and elsewhere, valuable, life-saving knowledge. The unquestioned scientific accuracy of the exhibits and the high grade showmanship under which they were presented were no doubt responsible for the large and enthusiastic audience. I am sure you will have no difficulty in repeating and increasing your marked success of last year.

"With warmest congratulations and best wishes,"

. . .

When the 1939 Fair opened, said Dr. Dublin, it was estimated that 3,000,000 persons would view the health exhibits if the Fair's attendance totalled 40,000,000. The number of visitors to these exhibits, however, reached the unprecedented figure of 7,500,000 out of a total Fair attendance of 26,000,000, or approximately one person out of every third visitor attended the Medicine and Public Health Building exhibits.

MISCELLANEOUS

RELIEF FROM STEAMED EYE-GLASSES*

DONALD W. JOHNSON, S.B., M.D.

Fairmont, Minnesota

MOST surgeons who wear glasses are subject to the annoyance of having them clouded by water vapor as the face mask diverts the warm moist breath upward along each side of the nose to condense on the cool surface of the glass, obscuring vision more or less. Various devices have been offered to prevent this very real difficulty, among them impervious masks; metallic inserts; loosely fitting sacs inclosing the whole head. Only more or less successful, these trappings are an added item of expense. They are not always comfortable.

Fig. 1.

Our nurses construct masks from ten thicknesses of 20x12 gauze taped about the perimeter, with the usual four-corner ties of tape. During eighteen years of surgery we have tried all the devices offered to prevent condensation on the glasses, with indifferent satisfaction. The simple expedient of applying a strip of adhesive ¼-inch wide for 3 or 4 inches along the upper edge of the mask and the skin of the nose and face (Fig. 1) has resulted in perfect satisfaction and efficiency. In addition to protecting the glasses from condensation, this arrangement forces exhaled air to filter through the gauze instead of spouting up along the nose, thus increasing protection to the surgical field from air-borne infection. It is also adaptable to every anatomy.

*From the Johnson Hospital.

All behavior is related and it is difficult to distinguish between the behavior which concerns the individual alone and that which concerns others. What a man does about his health, for instance, may concern his family, his business associates, the community and even the entire world.—The Purposes of Education in American Democracy, National Education Policies Comm., 1938.

MEDICAL BROADCAST FOR MARCH

The Minnesota State Medical Association Morning Health Service

The Minnesota State Medical Association broadcasts weekly at 11:00 o'clock every Saturday morning over Station WCCO, Minneapolis (810 kilocycles or 370.2 meters) and Station WLB, University of Minnesota (760 kilocycles or 395 meters).

Speaker: William A. O'Brien, M.D., Associate Professor of Pathology and Preventive Medicine, Medical School, University of Minnesota. The program for the month will be as follows:

March 2—Rheumatic Fever
March 9—Arthritis
March 16—Gout
March 23—Injuries of Joints
March 30—Exodontia

AMERICAN ASSOCIATION FOR THE STUDY OF GOITER

The annual meeting of the association will be held at Rochester, Minnesota, April 15, 16 and 17, 1940. Papers on various diseases of the thyroid; dry clinics by visiting guests; and operative clinics by members of the Mayo Clinic staff will occupy the three days of the meeting.

The association is again offering the Van Meter Prize Award for the best essay presented in competition prior to the meeting. The award consists of $300 and two honorable mentions. Those interested should communicate with Dr. W. Blair Mosser, 133 Biddle Street, Kane, Pennsylvania, not later than March 15, 1940.

THE UNITED STATES PHARMACOPŒIAL CONVENTION

In compliance with the provisions of the Constitution and By-Laws of the United States Pharmacopœial Convention, I hereby issue this second call to the several bodies entitled under the Constitution to representation therein to appoint three delegates and three alternates to the Decennial Meeting of the Convention for the Revision of the Pharmacopœia of the United States of America, which is to meet in Washington, D. C., on May 14, 1940.

WALTER A. BASTEDO, M.D.,
February 14, 1940. *President of the United States Pharmacopœial Convention.*

NOTICE—In order that the records may be brought up-to-date and checked, that card files may be prepared, and that the other functions of the Committee on Credentials may be performed, it is desirable that the Credentials of all Delegates appointed to attend this Decennial Meeting shall be in the hands of the Secretary, Mr. L. E. Warren, 2 Raymond St., Chevy Chase, Maryland, not later than *March 15, 1940.*

STATE MEETING

Reservations for the Minnesota State Medical Association's 87th Annual Meeting to be held in Rochester April 22, 23, and 24 should be made at once.

Attention of all members has been called to the advisability of making immediate arrangements because the 1940 meeting is more than a month earlier than the customary dates, and now only a little more than a month away.

The meeting is to be held in the fine new Mayo Civic Auditorium and a program of great distinction and interest has been arranged for the three-day session. In addition to the Auditorium meetings, there will be conducted tours to the Mayo Foundation Institute and special physio-therapy demonstrations under the direction of Dr. F. H. Krusen in the Museum building.

Governor Harold E. Stassen will address the annual banquet on Tuesday night, April 23, at the Rochester State Hospital, and the other guest speaker for the occasion will be Mr. Bernard H. Ridder, publisher of the *St. Paul Pioneer Press and Dispatch* who spoke at a recent University of Minnesota convocation on the subject "How the Peace of the World Was Lost."

Another unique feature of the meeting entertainment will be an Open House to be given Monday night, April 22, in the Arena of the Auditorium. The Mayo Clinic and the Olmsted-Houston-Fillmore-Dodge County Medical Society will be hosts for this occasion. There will be a floor show and buffet supper. All visiting physicians and their wives are invited to attend.

Monday's scientific sessions, scientific cinema, and round table luncheons will be conducted exclusively by members of the Mayo Clinic staff. Tuesday and Wednesday sessions will be conducted by other Minnesota physicians and a half dozen famous guest physicians among whom are Dr. Norman Jolliffe of New York City; Dr. Harry E. Mock and Dr. Paul B. Magnuson of Chicago; Dr. John O. Bower of Philadelphia, and Dr. Bernard H. Nichols of Cleveland. The latter will deliver the Russell D. Carman Lectureship annually provided by the Minnesota Radiological Society.

Round-table discussion luncheons on Tuesday and Wednesday will be conducted by Minnesota medical leaders and the guest speakers.

Three-quarters of an hour will be devoted during each morning and afternoon program session to scientific and technical exhibits and the scientific cinema. The Southern Minnesota Medical Society will present its annual medal for the best scientific exhibit submitted by an individual physician at this meeting.

WASHINGTON COUNTY

The regular monthly meeting of the Washington County Medical Society was held on the evening of February 13 at the Stillwater Club rooms.

Royal C. Gray, M.D., psychiatrist to the state institutions, gave a well prepared paper on "The incidents in childhood of psychosis and schizophrenia." The doc-

tor answered numerous questions afterward. E. M. Jones, M.D., Counselor for the Fifth (our) District of the Minnesota Medical Association, was present by request to advise us on some peculiar membership matters that have developed during the last year. The doctor also spoke of the importance of the Officers' Meeting at the St. Paul Hotel on Feb. 24. This meeting will be very important as new ideas and methods in the conducting of county welfare matters, as affected by new rulings, will be discussed by well-posted men from Minnesota and from other states, especially by Dr. Leland of Chicago. Several announcements were made. A letter from Stillwater Post No. 48, American Legion, was read. It requested, in behalf of the Legion, information in regard to blood donors and conveyed an invitation to members of the Society to their March 5 meeting at the Stillwater Armory. The object is to form a blood donor group at the Post here, certainly a very thoughtful and laudable act, which is heartily recommended by this Society. A committee was appointed to meet with them.

E. Sydney Boleyn, M.D., *Secretary*

Dilantin Sodium

The Council on Pharmacy and Chemistry reports that sodium 5,5-diphenyl hydantoinate, originally presented under the name Dilantin, had been redesignated "Dilantin Sodium" and is now marketed by Parke, Davis & Co. as "Kapseals Dilantin Sodium." Dilantin Sodium is an active anticonvulsant and relatively feeble hypnotic, used in the treatment of epilepsy. While the clinical studies of H. H. Merritt and Trace J. Putnam, and of O. P. Kimball, pointed to the therapeutic value of the drug the Council requested additional information. Pharmacologic studies were conducted in the laboratories of Parke, Davis and Company, and clinical investigations were made in a number of institutions, five of them in institutions for the treatment of epilepsy and kindred conditions. The pharmacologic studies show that Dilantin Sodium is of relatively low toxicity when administered orally to rats, rabbits and dogs, and much more toxic when injected intravenously. The side actions reported by one or more of the investigators include dizziness, dry skin, dermatitis, rash, itching, tremors, fever, nausea, vomiting, blurred vision, fatigue, apathy, difficult breathing and swallowing, nervousness, mental confusion and active hallucinations. The Council voted to accept Dilantin Sodium for inclusion in New and Non-official Remedies following receipt of an agreement from Parke, Davis & Co. that it would market the product under rigid restrictions, including those which further experience shall indicate, as well as the following: (a) It shall not be recommended for use by the general practitioner unless he is able to maintain a close (daily) supervision of the patient, until the scope of its usefulness as well as its side actions have been determined more accurately; (b) it is not to be recommended for the treatment of those patients whose seizures occur only at long intervals unless moderate doses of phenobarbital are ineffective or induce disagreeable side actions. The A.M.A. Chemical Laboratory has found the composition of Dilantin Sodium satisfactory. (J.A.M.A., Nov. 4, 1939, p. 1734.)

WOMEN'S AUXILIARY

Mrs. A. C. Baker, Fergus Falls, *President*
Mrs. E. V. Goltz, 2259 Summit Avenue, Saint Paul, *Publicity Chairman*

The mid-winter meeting of the State board of the Women's Auxiliary of the Minnesota State Medical Association was held in the Radisson Hotel, Minneapolis, January 23. The president, Mrs. A. C. Baker of Fergus Falls, presided at the business meeting at 10 a. m. Reports from the officers, county presidents and chairmen of various committees were heard and much time was devoted to discussions pertaining to *Hygeia* and Public Health activities throughout the state. A very interesting report was gipen by Mrs. Baker on the recent meeting of the national board held in Chicago. The following women were elected to positions on the nominating committee: Mrs. Thomas O. Young of Duluth, Mrs. Harry Ghent of Saint Paul, Mrs. George B. Eusterman of Rochester, Mrs. E. S. Mariette of Minneapolis, and Mrs. T. N. Fleming of St. Cloud. Luncheon followed the meeting and Dr. E. L. Meyer of Minneapolis entertained the group with motion pictures which he took on a recent trip to South America. Dr. B. S. Adams of Hibbing was the guest speaker. The meeting was very well attended and the following women attended: Mrs. A. C. Baker, Fergus Falls; Mrs. James Blake, Hopkins; Mrs. Sydney Boleyn, Stillwater; Mrs. T. J. Catlin, Buffalo; Mrs. J. A. Cosgriff, Olivia; Mrs. R. R. Cranmer, Minneapolis; Mrs. L. J. Dack, St. Paul; Mrs. N. S. Dungay, Northfield; Mrs. F. Elias, Duluth; Mrs. E. C. Eshelby, Saint Paul; Mrs. George Eusterman, Rochester; Mrs. T. N. Fleming, St. Cloud; Mrs. Harry Ghent, Saint Paul; Mrs. J. B. Gaida, St. Cloud; Mrs. E. V. Goltz, Saint Paul; Mrs. G. Haight, Detroit Lakes; Mrs. E. M. Hammes, Saint Paul; Mrs. L. P. Howell, Rochester; Mrs. R. J. Josewski, Stillwater; Mrs. O. O. Larson, Detroit Lakes; Mrs. Ernest Mariette, Minneapolis; Mrs. McGath, Rochester; Mrs. Martin Nordland, Minneapolis; Mrs. J. F. Norman, Crookston; Mrs. W. B. Roberts, Minneapolis; Mrs. J. J. Ryan, Saint Paul; Mrs. Theo. Sattermann, Pelican Rapids; Mrs. J. A. Thabes, Sr., Brainerd; Mrs. W. W. Will, Bertha; Mrs. T. O. Young, Duluth; Mrs. H. F. Wahlquist, Minneapolis.

The eighteenth annual convention of the Women's Auxiliary of the American Medical Association will be held in New York City, June 10-14, 1940, with headquarters in the Hotel Pennsylvania. In view of the fact that the second edition of the World's Fair will accelerate advance hotel reservations, it is urged that reservations be made immediately through the Housing Bureau which has been set up by the American Medical Association, namely Dr. Peter Irving, Room 1036, 233 Broadway, New York City, N. Y.

PROCEEDINGS of the MINNESOTA ACADEMY OF MEDICINE

Meeting of January 10, 1940

The regular monthly meeting of the Minnesota Academy of Medicine was held at the Town and Country Club on Wednesday evening, January 10, 1940. Dinner was served at 7 o'clock and the meeting was called to order by the President, Dr. James A. Johnson, at 8:15 p. m.

There were fifty-three members and one guest present.

Minutes of the December meeting were read and approved.

The secretary read a letter from Dr. Herbert Davis, of Saint Paul, asking that his name be transferred from the Active to the Senior membership list. This had been approved by the Executive Committee. Upon vote, this transfer was accepted.

The following Memorial to Drs. William J. and Charles H. Mayo was read by Dr. S. Marx White. A motion was carried that this be accepted, spread on the minutes and a copy sent to each family.

THE MAYO BROTHERS

Dr. William James Mayo, born at Le Sueur, Minnesota, June 29, 1861. Died July 28, 1939.
Dr. Charles Horace Mayo, born at Rochester, Minnesota, July 12, 1865. Died May 26, 1939.

To those who knew them best, as did their medical and surgical friends and neighbors in Minnesota, the fact that the elder brother, Doctor Will, was called by death just nine weeks after the loss of his brother, Doctor Charlie, seems almost a corollary of their useful and devoted lives together. During the later years of their father, Dr. William W. Mayo, they delighted to honor him, and with his death that generous spirit continued between them. When opportunity or honor came to one, he saw to it that it was shared by the other.

It is not the intention in this brief memoir to list the honors or recite the achievements of these two outstanding leaders in medicine and surgery. Their fame was national and soon became world-wide. Details concerning the life of each may be found in the July and August, 1939, issues of MINNESOTA MEDICINE, as well as in many other professional and lay publications immediately following the death of each.

To the members of the Minnesota Academy of Medicine the dates of their inaugural theses read before this body and the titles of subsequent contributions to our programs may be of interest.

Doctor Will's thesis entitled "A Discussion of Some Features of Peri-uterine and Peri-typhlitic Abscesses" was read at the meeting of May 3, 1890, and published in *Northwestern Lancet,* Volume X, page 166. From then on he presented papers on various subjects—Cancer and Its Surgical Treatment, Extra-uterine Pregnancy, Cicatricial Stenosis of the Esophagus and Its Surgical Treatment, Diagnosis of Surgical Diseases of the Kidney, Surgical Treatment of Suppuration, Preliminary Examination of the Surgical Patient, Diagnosis and Surgical Treatment of Certain Diseases of the Stomach, Primary Tuberculosis of the Intestine, Surgical Treatment of Some Benign Affections of the Stomach, Malignant Disease of the Gallbladder and Bile Ducts, Cancer of the Rectum. His last paper presented at an Academy meeting was on Splenic Anemia, read at the meeting of May 21, 1919.

Doctor Charlie's inaugural thesis on "Skin Grafting" was presented at the meeting of March 1, 1893, and published in *Northwestern Lancet,* Volume XIII, page 148. Subsequently papers were read on Brain Lesions the Result of Injury without Apparent Fracture, The Use of Heat in Surgery, and on Prostatectomy. The last paper of record was read on Uterine Prolapse at the meeting of April 1, 1914.

The names of both brothers have been on the list of honorary members of the Academy for many years.

Striking evidence of their organizing and professional genius may be found in the fact that they converted what would have been to most men a handicap, into an advantage unprecedented in the history of medicine. If they had done their work in a great medical center, their abilities would no doubt have been the same, but the performance could not have been so unique. Working in a rural community, these two men wrote their names as masters in their field on the roll which contained such names as Keen, Halstead, Fenger, Murphy and a long list of others of like quality, teachers and leaders in American surgery.

The late Dr. A. J. Ochsner of Chicago has told how in the earlier days he with Will or Charlie, one of the brothers at a time, went to see the work of this or that surgeon who had published some new method or tried some new type of operation, first in this country and later abroad. Learning with avidity it was not long before they themselves were in position to teach. Their lives exemplified one of the glories of medicine handed down from the days of Hippocrates in that he who learns shall pass on freely all he knows to all who seek to know. Learning from anywhere in the world where knowledge was to be found, they passed it freely on. Their teaching was personal, direct and practical. Not only did they give freely to all who visited them in Rochester, but the organizing genius built around their clinic a great center for postgraduate instruction. Untrammeled by tradition and free from control of any kind—governmental or educational—their quasi-isolation and freedom from restraint fostered a following and an audience limited only by the capacity of the physical plant and their personal endurance. With great foresight they sought to perpetuate the values of their situation. The history of medicine in the future must recognize their place in the establishment of coördinated, group effort and in furthering graduate teaching and research in medicine. Dr. William Mayo's long service as Regent of our University gave him an insight into

the needs and the technic of education. The Mayo Foundation coördinated with graduate teaching and research in the Medical School of the University of Minnesota has, as its objective, increase in and dissemination of knowledge in medicine and surgery. The desire of the founders is to return to the people by means of improvement in medicine and surgery that which the people have given the founders.

Many stories and incidents have been current illustrating the differing characteristics of their personalities. They were strong, striking and vigorous, and together they made a real contribution to their times. History has a place for them.

Certain incidents seemed at the time to be of little significance. The importance of these grows in retrospect. Their two operating rooms were side by side before other surgeons came into the group. Visitors then will recall incidents such as follow. Will, in his room, operating let us say on the thyroid or the prostate of a patient, would comment on the superior skill of Charlie in operations in the region, and invite the guests to take the first opportunity to observe his brother at this work. Or Charlie, in his room, operating in the abdomen, would deprecate his own skill, and invite his listeners to study what he truly believed to be the most skillful surgeon in this field, brother Will. The effect was electric. Their belief was genuine, and because they possessed it, it came alive and to be accepted.

These two men with brotherly devotion have lived and taught a lesson which all of us in medicine may learn. Working together with high purpose with and for each other and for their common good, their efficiency and performance increased not in arithmetical but in geometrical progression. It was as if together they made not two but four. We may learn that working together and not for ourselves alone, the good and the reputation of each will be enhanced.

Dr. Carl B. Drake, Saint Paul, retiring president, read the following Presidential Address. Lantern slides were shown.

SOME APPLICATIONS OF HYDRODYNAMICS TO THE CIRCULATION*

CARL B. DRAKE, M.D.
Saint Paul, Minnesota

Hydrodynamics is that branch of hydraulics which deals with liquids in motion. As applied to the circulation it is termed hemodynamics and involves a consideration of both physics and physiology. A clinician cannot be expected to delve very deeply into either of these allied sciences but may be pardoned for attempting to present some of the simpler laws of hydrodynamics and their application to clinical problems.

It should be understood that the conditions met in the circulation of the blood are comparable but by no means identical to the flow of water in pipes. In the circulation we have a pump acting at a variable rate and ejecting fluid into a closed system of elastic pipes of various and varying caliber. The circulatory system is supplied by a complicated nervous mechanism which regulates the heart rate and the caliber of the vessels according to the needs of the organism. The heart too has a marvelous ability to dilate and hypertrophy when there is need for greater output or force.

To consider a few facts concerning the behavior of liquids at rest and in motion:

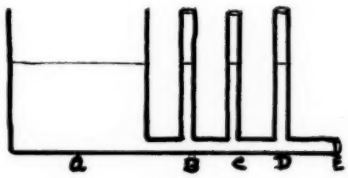

Fig. 1.

Figure 1 represents a tank, *A*, with a horizontal outlet pipe which is closed at *E*. Inserted vertically to the horizontal pipe are a series of tubes *B*, *C* and *D* known as piezometer tubes. Fluid levels in tank and tubes are the same and the side or lateral pressures over equal areas of surface at *A*, *B*, *C* and *D* are equal and are measured by the height of the columns of fluid in the tank and piezometer tubes. Thus fluid possesses potential energy due to its elevation and at areas *A*, *B*, *C* and *D* is measured by the height of the fluid irrespective of the quantity of fluid in the tubes or tank.

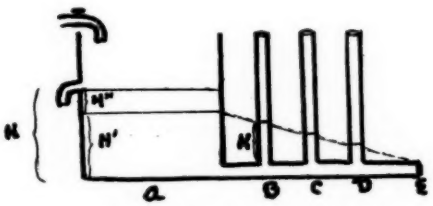

Fig. 2. From Gladstone.

In Figure 2, the outlet at *E* is open and the fluid level in the tank is maintained at a constant height *H*, by water from a faucet and an overflow. Water will flow from the outlet *E* at a certain rate and will possess a certain kinetic energy due to its velocity. The potential energy possessed by the fluid in tank *A* has therefore been converted into kinetic energy. Not all, however. A certain amount has been used to overcome resistance due to friction in the flow of the water in the horizontal tube. The amount of potential energy used to overcome friction is represented by the height *H'* and the remaining height *H''* represents the potential energy converted into kinetic energy at *E*.

The fluid levels in tubes *B*, *C* and D are successively lower than the level in *A* and represent the side pressures at *B*, *C* and *D*. Since the velocity in the hori-

*Presidential address before the Minnesota Academy of Medicine, January 10, 1940.

zontal tube is the same at *B*, *C* and *D* the loss of pressure in tube *B*, for instance, is due to the pressure required in overcoming friction from *A* to *B*, and the height in tube *B* represents the pressure necessary to overcome the frictional resistance from *B* to *E*. The blood vessels which leave the aorta do so at right angles and thus serve as piezometer tubes. Thus the pressure in the brachial arteries represents approximately the pressure in the aorta and is not directly affected by changes in velocity head in the aorta.

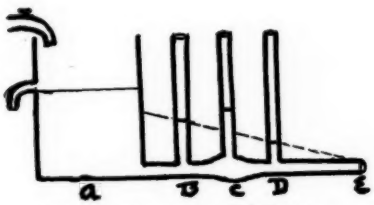

Fig. 3. From Best and Taylor.

The pressure head remaining constant, the velocity of fluid passing through a tube is inversely proportional to the cross section (sectional area) of the tube.[2] Thus in Figure 3 the velocity of the liquid at *C* is less than at *B* or *D*. Lateral pressure is inversely proportional to the velocity. Thus the fluid level in tube *C* is higher than in tube *B*, indicating a higher lateral pressure at *C*. The velocity however at *D* is the same as at *A*. Thus in an aneurysm of the aorta the velocity in the dilated portion is less and the lateral pressure greater. The greater pressure tends to further dilate the weakened wall of the aneurysm with further slowing of velocity and increase of pressure, a vicious circle.

Fig. 4. From Best and Taylor.

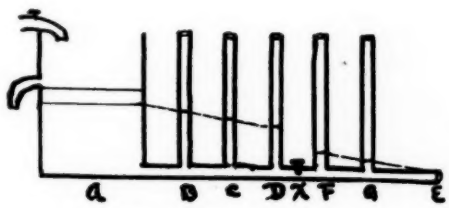

Fig. 5. From Howell.

According to the same laws the velocity in the narrowed tube at *C*, Figure 4, is increased and the lateral pressure is less as shown by the lower fluid level in tube *C*.

In Figure 5 a tap partially narrows the lumen of the tube at *X*. This results in a sharp lowering of the lateral pressure in tubes *F* and *G* beyond the narrowing.[3] This is the situation in coarctation of the aorta, in which condition the pressure beyond the narrowing, including that in the legs, is markedly diminished. The heart compensates by increasing the pressure above normal, proximal to the coarctation, and hypertension is found in the brachials.

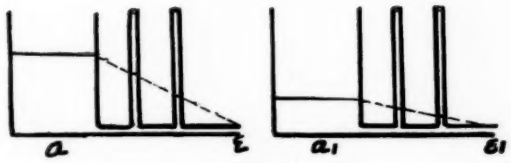

Fig. 6.

The cross section of a tube remaining constant, the velocity of the fluid in the tube is proportional to the pressure gradient. Thus in Figure 6 the higher pressure in *A*, than in *A I*, results in a greater velocity at *E*, than in *E I*. In hypertension the pressure is increased because the arterioles are narrowed. The velocity in the arterioles must be increased if the heart output is unaltered. Weiss found the average cardiac output in hypertension within normal limits.

Friction offers resistance to the flow of liquid through a tube and this friction varies with the surface area encountered by the liquid. At low velocities this frictional resistance is very little. At moderate velocities the frictional resistance varies as the velocity of the fluid while at high velocities it varies as some power of the velocity. This friction occurs not solely at the contact of the fluid with the sides of the tube[3] for it has been found that fluid does not flow through a tube as a column, and every portion of the fluid does not flow at the same velocity. Instead there is a layer of fluid next to the tube which moves slowly, while successive layers of fluid towards the center move more and more and the greatest velocity occurs in the center of the tube. Friction occurs for the most part between these peripheral layers of fluid. For this reason the frictional resistance is probably not greatly increased in atheromatous vessels.

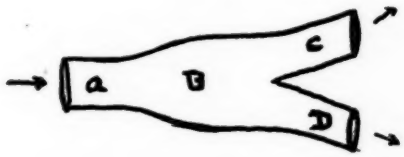

Fig. 7. From Gladstone.

Figure 7 shows fluid passing from *A* to *B* and to *C* and *D*, all of which areas are assumed to lie in the same horizontal plane to eliminate the effect of hydrostatic pressure. The cross section at *B* being greater than at *A* the velocity of the stream at *B* is less and the lateral pressure greater than at *A*. The sum of the

cross section at *C* and *D* being greater than at *B*, likewise the velocity at *C* and *D* is decreased from that at *B* and the lateral pressure tends to be increased. However, as fluid flows through tubes its lateral pressure head tends to decrease because of frictional resistance, and this resistance varies with the length of the tube, i.e., is proportional to the frictional surface encountered. The frictional surface per unit of length in tubes *C* and *D* is much greater than the frictional surface at *B* so that the friction effect of the greater surface on the pressure more than counterbalances the increase in pressure in *C* and *D* due to diminished velocity and results in an actual decrease in pressure at *C* and *D*.

Thus in circulation of the blood as arteries leave the aorta the cross section of the arterial field is increased, which tends to lower the blood velocity in the middle sized vessels and increase the blood pressure; but the increased frictional surface encountered in the middle sized arteries results in an actual lowering of the blood pressure.

Fig. 8.

Figure 8, *A*, represents a cross section of the aorta and *B* the sum of the cross sections of the arterioles somewhat larger than *A*. Although the cross sectional area of the blood stream in the arterioles is greater than that of the aorta, the sum total of surface areas of the arterioles is much greater than that of the aorta, which results in a greatly increased frictional resistance. We know that the frictional resistance is proportional to the surface area in contact with the stream. While the cross sectional area of the capillaries is 600 to 800 times that of the aorta and the sum total of the surface area of the capillaries affording frictional resistance is enormously increased, on the other hand the great increase in the bed of the blood stream results in a marked slowing of the blood flow (to 1 mm. per second) and in the presence of such a slow velocity friction is relatively slight.

Both right and left ventricles eject blood by a shortening of the muscles, which decreases the size of the ventricles, thus forcing the blood into the pulmonary artery and the aorta. Their stroke volumes are equal and also of course their minute volumes (the blood ejected in a minute). The left ventricle propels blood into the aorta during systole, and the aorta is distended and its elasticity maintains arterial pressure during diastole. No diastolic pressure could be maintained in the arterial system were it not for peripheral resistance. This is supplied largely by the arterioles.

Assuming the muscular contraction of the ventricles to be isotonic, that is, that the rate of contraction is the same throughout systole and that the ventricular cavity were the shape of a sphere and emptied completely during systole, much more blood would be expelled during early systole than during late systole.[31]

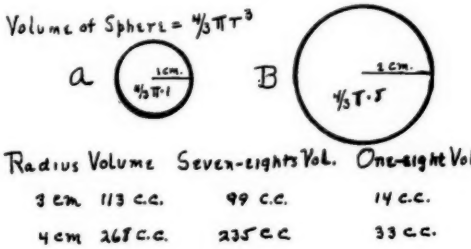

Fig. 9.

Figure 9 represents two spheres with radii of 1 and 2 cms., respectively. The volume of a sphere is $4/3\ \pi\ r^3$. The volume of sphere *A* with a radius of 1 cm. is $4/3\ \pi \times 1$, or about 4 c.c. A sphere with a radius of 2 cm. is $4/3\ \pi \times 8$, or about 32 c.c. Thus a sphere with twice the radius of another has a volume eight times as great. Thus if the ventricle were a sphere it would expel seven times as much blood during the first half of systole as during the last half, while its radius was being reduced by half, providing it completely emptied with each contraction. It seems warranted to assume that the heart expels at least seven-eighths of its content during the first half of systole. This relationship of eight times the volume in a sphere with twice the radius applies no matter what the size of the sphere and in cardiac dilation seven-eighths of the ventricular content may be a considerable volume of blood.

The great amount of blood ejected from the ventricle during the first part of systole largely distends the aorta and raises the intra-aortic pressure from its diastolic to its systolic level. This results because more blood enters the arterial system during this time than leaves through the capillaries. Much less blood being expelled by the ventricle during the latter half of systole and at a lesser rate than the blood leaves the arterial system, the intra-aortic pressure in late systole drops.

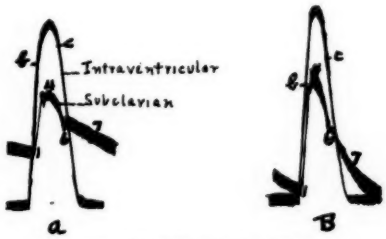

Fig. 10. Modified from Wiggers.

Pressure curves in the ventricle and subclavian artery (or aorta) are shown arranged synchronously in Figure 10, *A*.[31] As the ventricle begins to contract, the

intraventricular pressure rises to the point *b*, during which its contraction is isometric, that is, no actual shortening of the muscle fibers of the heart has occurred. As the intraventricular pressure arises above the diastolic pressure in the aorta, the pressure within the aorta begins to rise (1-4). The high point of pressure in both ventricle and aorta is reached at about midsystole and both pressure curves descend during the latter part of systole. The aortic valve closes at 6, indicated by the dicrotic notch, when the intraventricular pressure *c* is only moderately higher than it was at the beginning of systole *b*. The result of this lower intra-aortic pressure at the end of systole is sparing to the aortic cusps.

As was stated, the blood pressure in the systemic circulation decreases progressively towards the periphery. In the aorta it varies between systolic and diastolic values. In the medium sized vessels[2] the mean pressure is about 20 mm. Hg. less than in the aorta and it falls some 50 to 60 mm. in the arterioles. In the capillaries it has been estimated at about 20 mm. Hg. and it falls progressively in the veins to about 5 mm. of water in the vena cava. The difference between diastolic and systolic pressures gradually becomes less as the periphery is approached and disappears in the capillaries and veins. The venous pressure in the upper portion of the body reaches zero in the lower jugular veins, beyond which it is negative, being —35 to —80 mm. of water at the right auricle during relaxation of the auricles.

Several factors assist the return of the blood through the veins to the right heart. Respiration is one. In the pleural space there is a negative pressure of about —6 mm. during inspiration which becomes about —2.5 mm. Hg. during expiration.[3] This negative pressure within the thorax is exerted on the vena cava and added to the slight positive pressure within the large veins produces return blood flow to the right auricle. The contraction of the diaphragm increases intra-abdominal pressure, which in turn exerts pressure on the inferior vena cava. The presence of valves in the inferior vena cava and in the iliac veins prevents the blood from returning to the periphery and thus periodic abdominal pressure assists in blood return to the right auricle. Muscular action in the lower extremities also aids venous flow in the extremities. The assistance to flow rendered by these several factors is greatly increased during exercise.

Variations in intrathoracic pressure affect the circulation. With the glottis and respiratory track open there is a negative pressure in the thoracic cavity during both inspiration and expiration due to the elasticity of the lungs. With the glottis closed, however, forced expiration (a grunt) may increase the intrathoracic pressure to 60 or 100 mm. Hg., which overcomes the negative pressure in the pleural space, and being much greater than the pressure in the inferior and superior vena cava, may prevent filling of the right auricle. If maintained long enough, it may produce syncope. This effect on venous pressure is evident if one watches an infant at stool. Its face becomes suffused with blood and the vessels in the neck become distended. On the other hand, forced inspiration with the glottis closed causes a marked increase of 30 to 80 mm. Hg. in the negative pressure in the thorax. In asthma the assistance rendered return circulation by forced inspiration should about counteract the interference afforded by forced expiration. Perhaps this explains the absence of evidence of cardiac strain in many of these cases.

The velocity of the blood flow varies greatly in different regions of the circulatory field. It is greatest in the aorta during early systole, while it is zero at the root of the aorta during diastole. We have mentioned that as arteries branch off the aorta the blood bed is increased, which tends to reduce velocity. The bed of the stream is so large in the capillaries that the velocity there is minimal. Such a slow flow in the capillaries facilitates exchange between blood and tissues. In the veins the velocity increases as the heart is approached, being greatest in the superior and inferior venæ cavæ, although the velocity here is not as great as in the aorta as the combined cross sections of these large veins is greater than that of the aorta. The circulation time from right jugular to left jugular, which represents the shortest course from right jugular to right heart, lungs, left heart, head and left jugular has been determined to be twenty-three seconds.

A number of tests for determining the velocity of blood flow have been proposed for clinical use.[1] Five minims each of ether and normal saline are injected into the median basilic vein and the time it takes for the odor of ether to be noticeable to patient or observer is recorded. This measures the velocity of the blood stream from the vein to the lung. The time period varies in normals but four to eight seconds may be taken as the normal figure, an increase in this time indicating right heart failure. Similarly the velocity of the circulation from the median basilic vein to the tongue is determined by the injection of different substances. Saccharine produces a sweet taste, decholin a bitter taste, and calcium gluconate a sensation of heat in the throat. The time in normals is about eight to sixteen seconds and lengthening of the time indicates slowing of the circulation between these two points, due to a weak left ventricle or both left and right ventricles. The difference between the vein to tongue and the vein to lungs times would indicate the time taken from lungs to tongue and an increase above the normal would indicate an impaired left ventricle alone. Nausea and vomiting sometimes accompany the decholin test and an appreciable percentage of all the tests is accompanied by thrombosis of the vein. It is likely, however, that these tests are of value in certain cases.

The blood pressure in the pulmonary circulation is normally about 40 systolic and 12 diastolic, with a mean pressure of about 20 mm. Hg. Although the right ventricle pumps the same amount of blood as the left ventricle during the same period of time, its work is only about one-third that of the left, as most of the work of the ventricles is in overcoming resistance. The right ventricle has need therefore of a less powerful muscle.

Certain factors affecting the blood pressure in the popliteal artery are worth considering. Figure 11, *A*, shows a tube of uniform caliber through which fluid is

flowing at a uniform rate and tubes of smaller uniform caliber 1, 2 and 3 tapping the tube at different angles. Tube 2 is a piezometer tube and the pressure as indicated by the fluid level is unaffected by the velocity in the main tube. The fluid level in tube 1, however, is lower than in tube 2 and the level in tube 3 is higher than in tube 2, pressure due to velocity head being subtracted in tube 1 and added in tube 3 to the lateral pressures. Figure 11, *B*, shows schematically the vessels leaving the arch of the aorta at right angles and the bifurcation of the aorta into right and left iliacs. The angles at which the iliac arteries leave the aorta explain the higher blood pressure in them and in the popliteals than in the aorta and brachials even in the horizontal position. Pressure due to velocity is added to the lateral pressure in the popliteals.

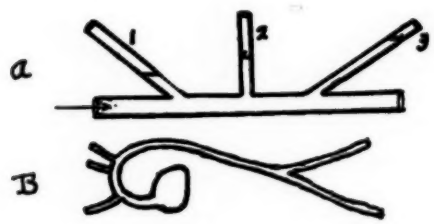

Fig. 11.

Hydrostatic factors have little effect on the circulation when the individual is in the horizontal position. In the erect position, however, it aids arterial flow in the lower extremities, increasing blood pressure in the popliteals. In this position it hinders return flow from the lower extremities to the heart to the extent of the pressure of a column of blood of about three and a half feet (77 mm. Hg.); in the upper extremities it assists arterial flow but hinders venous flow and in the head its action is the opposite. In one patient with normal circulation, the brachial blood pressure was 135-85 and that in the leg 168-108, both taken in the recumbent position. On standing, the blood pressure reading in the leg was 200-160.

The greater the viscosity of a fluid the greater the friction encountered in passing through tubes. Blood is five times as viscous as water and its viscosity is increased in polycythemia, leukemia and anhydremia. This increase, however, does not cause any significant deviation from normal in the circulation.

The total blood in circulation amounts to about five or six liters. In addition to the circulating blood there is an appreciable amount of blood lying passive or moving very slowly in the spleen, liver and so-called subcapillary spaces which is mobilized under certain conditions, such as during exercise and after eating.[13]

There is no uniformity of opinion as to the amount of blood pumped by each ventricle at each contraction (stroke volume) or as to the amount pumped in a minute (minute volume). Some[21] state the stroke volume at rest is 50 to 60 c.c. This would amount to a minute volume of about 4,000 c.c. Some writers estimate that the heart is capable of varying its amplitude of stroke from three to ten fold. Henderson,[15] on the contrary, states that, "Convincing evidence from a wide range of sources indicates that in vigorous men and other mammals of all sizes the stroke volume of the heart is a nearly constant quantity for each individual. Both during rest and work it is of the order of magnitude 1.5 to 2 c.c. per kilo body weight." According to this view the stroke volume would be 105 to 140 c.c. for a 154-pound man and 150 to 200 c.c. for a 220-pound man. According to these figures the minute output for a 154-pound man would vary from 7,350 to 9,800 c.c. at a pulse rate of seventy and from 10,500 to 14,000 for a 220-pound man with the same pulse rate of seventy.

During exercise[21] the systolic blood pressure may be elevated to 160 or 180 mm. Hg. and the diastolic to about 120. The heart rate also increases during exercise, more in those accustomed to sedentary life than in athletes. A doubling of the heart rate would result in twice the heart output, providing the ventricle filled as completely during exercise as at rest. If the stroke volume is increased during exercise a doubling of the heart rate will more than double the minute volume. Best and Taylor state that the minute volume may increase from 9 to 37 liters during exercise. This cannot result from an increase in heart rate alone and presupposes a greater stroke volume during exercise. The duration of systole changes very little with increase of heart rate, but most of the rate increase is at the expense of diastole. Wiggers[21] has shown that the minute volume increases proportionately with heart rate up to 60 to 78 per minute. With rates of 78 to 210, the minute volume steadily increases but not proportionately with the heart beat. This means that the stroke volume in rates from 78 to 210 is less than at rates below 78 and is contrary to the idea that the ventricle dilates during exercise. Beyond the rate of 210 the minute volume shows a decrease, as the ventricle does not have sufficient time during diastole to fill well. This occurs in paroxysmal tachycardia, a case having been reported in which the stroke volume was reduced from 70 to 12 c.c. Such a marked diminution in blood supply if prolonged may be serious. One case has come to my attention in which a heart rate of about 266 lasting two or three days in a six-months old infant was followed by a serious deafness, presumably due to prolonged undernutrition to the delicate auditory nerve fibers. In another case of a forty-three-year-old physician death occured in about twelve hours from an attack of paroxysmal tachycardia because he insisted on actively caring for his patients.

It seems certain that the capacity of the ventricle varies in different normal individuals. The trained athlete doubtless has a larger ventricular capacity and a greater musculature than one unused to exercise. The minute volume is certainly increased greatly during exercise but probably not because of any greatly increased stroke volume. Certainly x-ray examination of hearts during exercise fail to indicate increase in diastolic volume. We have noted the marked effect increased rate and depth of respiration and muscular action in the lower extremities have in increasing the return flow

of blood to right heart. This results in a better supply of blood to the right heart and more rapid filling during diastole.

The term work is used in a special sense in physics. A man leaning against a wall to keep it from falling is not expending energy in work as the term is used in physics. Work in physics is the product of force expended by the distance it acts. The work of the heart is the force required to move a certain amount of blood times the distance moved and the work required to give the blood a certain velocity. It has been determined that the energy of the heart used in giving velocity to the blood amounts to less than one per cent of the total work of the heart. Therefore the velocity factor of the heart's work may be ignored in calculating roughly the work done. The force exerted by the heart at each stroke is the same as the peripheral resistance overcome. The heart expelling 100 c.c. of blood at each stroke through a tube 3 cm. in diameter will propel it 14 cm. The mean resistance encountered in the aorta is 97 mm. Hg or 132 cm. of water. If the heart were connected with a tube of water it would therefore at each contraction lift a column of water 132 cm. high and 7 sq. cm. in cross section a height of 14 cm. Such a column of water weighs 924 grams. Thus at each stroke the heart does about 13,000 gram-centimeters of .13 kg. meters of work. Each minute the work of the heart would be .13 x 80 (pulse rate) or about 10 kg. meters. This is the equivalent of raising 10 liters of water 1 meter each minute. This applies to the left ventricle alone and as the work of the right heart is about a third of that of the left, the total work of the heart would be roughly raising 13 liters of water one meter each minute, the individual being at rest.

The caliber of the arteries is subject to variations and is controlled by the sympathetic nervous system. There is probably a vasodilator center as well as a vasoconstrictor center. With constant pressure head the velocity head is proportional to the sectional area of the tube but the quantity of fluid passing through the tube per unit of time (the volume flow) is proportional to the forth power of the diameter of the tube (Poiseuille's law). Slight changes in the caliber of the peripheral arteries therefore produce great variations in the volume of the blood flow. In addition to the vasodilator and the vasoconstrictor centers the caroid sinus doubtless plays an important part in regulating blood pressure and blood supply. Increase of blood pressure in the carotid sinus causes slowing of the heart and dilatation of the peripheral vessels, while decrease in pressure in the sinus causes acceleration of the heart and vasoconstriction.

Valvular heart disease is accompanied by changes in the hydrodynamics of the circulation. In mitral regurgitation of mild degree the left auricle and the pulmonary veins may care for the increased blood content during systole without causing an increase in intrapulmonary pressure. If hypertension is present as well as mitral regurgitation, a greater amount of blood will be regurgitated into the pulmonary circuit during systole, which may well cause pulmonary congestion. In mitral stenosis intrapulmonary pressure and blood volume are increased and sclerotic change in the pulmonary vessels follows. In aortic stenosis systole is prolonged, intraventricular pressure systole is increased, the stroke volume is decreased, the velocity of the blood passing through the aortic valve is increased, while both systolic and diastolic pressures are lower than normal.

The hydrodynamic changes in circulation which occur in aortic regurgitation are marked and have been the subject of considerable study. It has been argued that little blood actually regurgitates in this valvular lesion. That this may be considerable, however, is proven by the greater capacity of the left ventricle compared with the right as found at autopsy, the difference in capacities indicating the leakage during life. Thus the stroke and minute volumes in the presence of this lesion may be greatly increased at rest and in the presence of a normal pulse rate. The diastolic blood pressure is characteristically low and by way of compensation the systolic pressure is increased. The resultant mean pressure, however, is below normal, which is given as the reason for the characteristic pallor in these patients. More blood than normal being expelled from the left ventricle during systole, the velocity of the blood in the arterial tree is much increased above normal during early systole. The systolic pressure in the popliteal arteries being affected by changes in velocity shows therefore a marked elevation above normal in the presence of this lesion. The velocity factor in the work of the heart is increased, and, according to Evans,[8] may even exceed that in overcoming intra-aortic pressure. The increased velocity of the blood flow in the arteries in early systole, according to Gladstone,[11] accounts for a more rapid flow through the capillaries. Stewart had argued the presence of a reflex vasomotor dilatation to spare the heart in this condition. Vasomotor dilatation is not, however, in keeping with the pallor present with this lesion.

The capillary pulse is characteristic of aortic regurgitation. It indicates a high pulse pressure which is due to a much greater output of blood from the heart during early systole under an increased velocity, which suddenly fills the capillaries and a low diastolic pressure, due to the leak in the aortic valve. The decrease in intra-aortic pressure during late systole is abnormally great (Fig. 10, *B, c*), but the extreme low pressure in the presence of this lesion occurs during diastole and the blanching of the capillaries is probably due to the regurgitation. In the original curves by Wiggers the point *c* in figure *B* is not designated. Although stated to be abnormally low, it must be higher than *b*.

In the presence of both aortic regurgitation and stenosis, blood pressure readings are influenced by the degrees of leak and narrowing of the valve. A high pulse pressure is usually present, although one encounters some cases in which the pulse pressure is within normal limit, the explanation of which is not clear. However, if the stenosis is extreme, systole is prolonged and diastole, during which the leak occurs, is correspondingly shortened, intra-aortic pressure is lower than normal, the left ventricle does not completely empty and there is congestion in the left auricle with a more rapid filling of the ventricle in diastole—all of which tends to minimize the amount of blood regurgitated.

Circulatory failure is of two types—the so-called forward and backward types.[14] The forward type is due to a diminished cardiac output with a diminished filling of the peripheral vessels. Circulatory competence depends on a distended arterial system. Diminished minute volume beyond a certain point results in failure of the circulation. This occurs in paroxysmal tachycardia, heart block and myocardial disease. It also occurs with any marked reduction in blood volume such as that following severe hemorrhage, secondary traumatic shock or severe burns. Decline in blood volume tends to produce a decline in venous pressure which results in less blood reaching the heart.

Backward failure is the more common type and is known clinically as decompensation with passive congestion. The failure may be due to the left heart or both left and right heart. The left ventricle or auricle or both become congested and there is pulmonary congestion with right heart failure, liver congestion and ascitis. Common causes are mitral stenosis and regurgitation, left ventricular failure in hypertension and aortic regurgitation.

Circulatory failure of neurogenic origin occurs in simple fainting from emotional causes, postural hypotension, knock-out blows and in primary shock following operation or wounds even without loss of blood. The manifestation is too sudden to be due to eliberation of toxins or loss of blood plasma and can only be explained on a nervous mechanism. In this type of circulatory failure dilatation of the peripheral vessels results in a lowering of peripheral resistance and blood pressure. The venous pressure is low and less blood is returned to the heart. Assuming the horizontal position is important, and thus the hydrostatic interference of return circulation to the heart is overcome. This occurs spontaneously as the patient falls in fainting, but maintenance of upright position may prove fatal.

In secondary shock following operation or wounds, the shock occurs several hours after the injury and is characterized by pallor, cold sweating, fall in temperature and blood pressure and a small rapid pulse.[14] It has been shown that an oligema exists due to a leakage of plasma from the blood into the tissues and the great veins are depleted. The blood shows a high hemoglobin and red cell count. According to recent work this loss of blood plasma is probably due to a dilatation of the capillaries produced by an eliberated toxic substance resembling histadine. Several theories as to its causation have been advanced, but as yet no final answer as to the exact mechanism involved can be given. Treatment consists in rapid addition of fluid to the depleted blood volume.

Simple fainting is common. It occurs at times in young women with feeble musculature on standing for the dressmaker or when soldiers, not necessarily with poor musculature, stand long at attention. It is due to a cerebral anemia which in turn is due to an insufficient venous return to the heart. The hydrostatic pressure exerted in the venous system leading from the lower extremities is opposed to the comparatively low pressure within these veins. This interference with circulation by the force of gravity is well known in the case of the rabbit, which, used to the horizontal position, may die if held in the vertical position too long. The rabbit lacks the vasoconstrictor mechanism necessary for adjustment in the upright position. On fainting, the individual automatically assumes the horizontal position and the blood again reaches the heart. It might be serious if the upright position were forcibly maintained. It is questionable whether locking the knees, namely, hyperextension of the knee joints, tends to cause fainting by excessive pressure on the popliteal veins. Voluntary deep respiration and grunting should aid in preventing fainting.

Some individuals faint easily and of course the blood pressure falls at such times. There is, however, a severe form of hypotension and syncope associated with the assumption of the erect posture which is comparatively rare and quite different from mere fainting.[7] This is characterized by syncope and hypotension and a slow and unchanging pulse on standing, thus indicating a disturbance in the adjustments normally made through the sympathetic system to changes in position. The condition is often associated with other evidence of neurological disease. Blood is pooled in the dependent vessels and circulatory failure of the forward type occurs. Ephedrin and abdominal binders help in some cases.

In hypertension the work of the heart may be increased 40 to 50 per cent at rest. That is why the marked increase in work of the heart accompanying strenuous exercise should be avoided. The stroke and minute volumes are generally normal in amount.[29] As a narrowed arteriolar bed is present and the same amount of blood circulates, its velocity must be increased in the arterioles. This increase in velocity is accompanied by an increase in resistance. Any attempt at therapy aside from avoiding strenuous exercise should be directed at overcoming the arteriolar resistance rather than attempting to lessen the force of the heart action.

In arteriosclerosis of the larger arteries, hydrodynamics of the circulation tends to approach that encountered in rigid tubes. The blood in the aorta in early systole is less taken care of by the diminished elasticity of the aorta and the pressure transmitted to the aorta is more directly applied through the column of liquid to the periphery. The velocity of the pulse wave we know is increased. The pressure during diastole is less well sustained and is consequently lower. The systolic pressure we would expect to be higher by way of compensation. More of the work of the heart is expended in kinetic energy.

The effect of arteriosclerosis involving the large vessels on blood pressure is not at all clear. We see elderly individuals with evidence of considerable change in their vessels and little change in their blood pressures. On the other hand, it is difficult to explain blood pressure reading of 210-90 or 160-60 in elderly individuals on a basis of arteriolar change and I am inclined to attribute such a reading to sclerosis of the large vessels, although Weiss does not concur in this interpretation.

In coarctation of the aorta we have a narrowing of the aorta with local increase in the velocity and lowered pressure. Beyond the constriction the velocity becomes less and the pressure greater, but still below normal level. The heart compensates to overcome the increased resistance by hypertrophy and the pressure proximal to the constriction is increased. Increase in collateral circulation provides for a return of the blood volume which cannot take its normal course because of the narrowed aorta.

In adhesive pericarditis there is a mechanical interference with the normal hydrodynamics of the circulation. Adhesions to surrounding structures necessitates greater muscular work on the part of the heart. As adhesive pericarditis is often associated with valvular leakage there is in these cases need of dilatation as well as hypertrophy. If the thickened and often calcified pericardium prevents the required dilatation, the circulation is handicapped even with the patient at rest. If the right ventricle cannot fill sufficiently during diastole, there is back pressure and the characteristic ascites. Less blood expelled by the right heart results in less blood reaching the left ventricle and a reduced supply to the systemic circulation. The brilliant results from surgical removal of the constricting pericardium are obtained by permitting adequate diastolic filling of the heart. An important point in connection with the operation is the necessity of relieving the constriction of the left ventricle before the right. If the right ventricle is relieved first, its filling, and hence stroke volume, become greater than the left ventricle can accommodate, which may result in fatal pulmonary congestion.

In the presence of pericarditis with effusion it is readily understandable how a rapid accumulation of fluid in the pericardial sac can easily be fatal by preventing normal filling of the heart chambers. The pericardium is known to be quite resistant to acute distention. In filling, the muscles of the heart chambers exert no active suction on the blood in the large veins but filling is dependent on the low pressure in the large veins plus the negative intrathoracic pressure exerted on the heart itself.

The presence of a patent ductus arteriosis produces a disturbance in pressures. The mean blood pressure in the aorta being normally about four times that in the pulmonary artery and the aortic pressure being transmitted to the pulmonary artery throughout systole and diastole, the pressure and the volume of the blood to the lungs is greatly increased above normal, thus increasing work of the right ventricle. The right ventricle hypertrophies and dilates. Ligation of the patent ductus has proven comparatively simple and very successful in operations recently reported.

In arteriovenous fistula the arterial blood stream flows into a vein, the pressure of which is much less than that in the arterioles. Thus peripheral resistance is less[21] and the heart shows marked hypertrophy and dilatation in most cases, the diastolic pressure is lower, and the systolic higher than normal by way of compensation. Operation results in a return of heart and blood pressure to normal.

The blood pressure in the pulmonary circuit in man is estimated at about 40 systolic and 12 diastolic. Increase in the pulmonary blood pressure is, according to Moschowitz,[22] almost always a secondary process and is accompanied by arteriosclerosis of the pulmonary arteries. It occurs with any lesion in the left heart which results in back pressure in the lungs. Mitral stenosis is a common cause and in severe cases the entire lung field shows on x-ray increase in lung design from blood vessel thickening. The independence of arteriosclerosis of the systemic and pulmonary circulations indicates, according to Moschowitz, that the cause of arteriosclerosis is not toxic, metabolic nor dietary.

The fall in blood pressure encountered in spinal anesthesia is caused by the cutting off of the vasoconstrictor action of the sympathetics on the blood vessels. While there are believed to be both vasoconstrictor and vasodilator nerves to the arteries with respective centers in the brain, there is some question as to the mode of action of the dilator nerves, that is, whether it is an active process or not. Section of a nerve trunk containing both kinds of fibers and stimulation of the peripheral segment results in arterial constriction which shows a greater action on the part of the constrictor fibers. This explains the dilating action on putting the sympathetic fibers out of commission by spinal anesthesia. The splanchnic and leg vessels in spinal anesthesia become dilated and peripheral resistance is lowered, which results in a lowering of blood pressure and increased pulse rate, and if the dilated vessels acquire too much of the circulating blood, the venous return to the heart is diminished. In hemorrhage there is a prompt compensatory vasoconstriction which tends to maintain blood pressure. This is impossible in spinal anesthesia and therefore this form of anesthesia is contraindicated following hemorrhage or in operations likely to be accompanied by considerable loss of blood. The importance of the horizontal position in spinal anesthesia is apparent. Ephedrine acting on the unaffected vessels tends to minimize the lowering of blood pressure in these cases.

The application of some of the laws of hydrodynamics to normal circulation and to a number of abnormal conditions encountered clinically has been attempted in an effort to make the subject of circulation more intelligible and therefore more interesting.

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Discussion

DR. S. MARX WHITE, Minneapolis: This presentation ought not to go without discussion. I do not consider myself capable of discussing the details of this paper but I am interested in this fact that, as medicine grows and our knowledge in medicine increases, increasingly we are interested in physiology. It is true that the physiologist has been able to add very greatly to our knowledge. Physiology is one of the fundamentals in the science of medicine. Everything that Dr. Drake has presented has been of extraordinary value. He had not the time to go into other fields of hemodynamics, such as those that may play a part in fluid interchange through the vessel walls. A difficulty in all of this is that we are facing a complexity of the forces with which we deal. While he was discussing the forces in hypertension and hypotension, my mind went back to a couple of incidents that impressed it on my mind. We have been taught that in aortic stenosis there is, as a rule, much less sclerosis in the proximal portion of the aorta than is commonly found in the same age group. A patient of fifty-five years whom I had watched for several years had had an attack of rheumatic fever at the age of eighteen, none since. At autopsy, marked sclerosis was found in this vessel. Some other factor, possibly hereditary, had stepped in to modify the picture.

I did not hear Dr. Lepak's paper on hypotension at the last meeting, but I have in mind a man whom I had studied for ten years. We found marked static hypotension to systolic pressures of 70 mm. of mercury and even lower. At no time did we find blood pressures over 135 systolic or 90 diastolic. We overcame the spells of fainting which the man had while shaving in the morning and which had been looked upon previously as mild epileptiform seizures. This was corrected largely by an abdominal belt designed to prevent over-distention of abdominal veins. This man died on the sixth day of his first attack of coronary occlusion. We found he had a heart markedly increased in weight. I don't introduce these to confuse the picture; I do it in order to bring our attention back to the fact that in the work of the physician and surgeon we are dealing with a multiplicity of forces in which many things come into the picture.

DR. MOSES BARRON, Minneapolis: The study of hydrodynamics in heart disease has assumed importance in recent years and has helped clarify many phases of congestive heart failure. It has now been fairly well established that congestive heart failure is best explained by the back pressure theory. The old concept of the forward failure theory has been abandoned. A patient with advanced heart failure from any cause, whether from hypertension, coronary disease, valvular disease or any other etiological factor, presents increased venous pressure. The minute volume cardiac output is often normal until an extreme state of heart failure develops and at times may be normal even then. There are only a few conditions affecting the heart which would produce definitely a diminished minute volume output. The two important ones are: (1) constrictive pericarditis, when an insufficient amount of blood reaches the heart because of the inability of the blood chambers to receive the normal amount; and (2) when there is tricuspid stenosis present, a condition which also results in inflow stasis. These heart conditions result in forward failure, otherwise forward failure comes when there is peripheral vascular collapse, a condition found in severe shock. A loss of tone of the blood vessels results in increased vascular bed, but especially an escape of fluid through the capillary endothelium with a diminished return flow of blood to the heart. It is important that we recognize these two distinct types of circulatory insufficiency, the one due to cardiac weakness and that due to peripheral vascular collapse. The treatment of the two conditions is altogether different. In the first, cardiac stimulants are indicated; while in the second the attempt should be made to increase the vascular tone and supply more fluid to the circulating system.

Another interesting point brought out by Dr. Drake is the inconstancy of the blood pressure associated with arterial sclerosis. If the sclerosis involves the larger vessels without affecting the pre-capillary arterioles, there may be no increase in the systolic pressure. If there is a high systolic pressure associated with the low diastolic, it may signify that there is sclerosis of the larger blood vessels which has eliminated the elasticity and prevents the vessel wall from contracting down upon the circulating blood. This lack of contraction explains the low diastolic pressure. In cases of aortic regurgitation the low diastolic associated with a high pulse pressure is probably not the result of the amount of blood regurgitating into the ventricle but rather of some reflex dilation of the peripheral vessels. The thrust of blood at systole into relaxed blood vessel walls explains the loud pistol shot tone so often elicited in cases of aortic regurgitation.

DR. DRAKE, in closing: I wish to thank Dr. White and Dr. Barron for their discussions. Dr. Barron's explanation of the reason for the comparatively low diastolic pressure readings in some cases of hypertension with arteriosclerosis is particularly interesting.

The meeting adjourned.

A. G. SCHULZE, M.D., *Secretary*

TRANSACTIONS of the MINNEAPOLIS SURGICAL SOCIETY
Stated Meeting, Thursday, November 2, 1939

President, Dr. Willard White, in the Chair
Secretary, Dr. Harvey Nelson

THE SURGERY OF PEPTIC ULCER

MARTIN NORDLAND, M.D.
Minneapolis

The conception that a peptic ulcer is an acute process healing rapidly and spontaneously and that each attack of symptoms is due to a new ulcer has been widely accepted. The surgical treatment of peptic ulcer is indicated only for complications, namely, perforation, gross hemorrhage, pain intractable to medical management, pyloric obstruction which is not amenable to medical management, and gastric ulcers questionably malignant. All of these complications, with the exception of perforation, may be favorably affected by dietary measures.

While the total number of cases requiring surgery does not vary, the number of patients operated upon for different indications has been greatly modified. Surgical interference for the so-called intractable pain has diminished 50 per cent, while the number of patients operated on for massive bleeding has increased markedly in recent years. Gastro-enterostomy, which still has its place in the selected case, is no longer employed as a routine procedure. The pyloroplasty of Finney and the gastroduodenostomy of Wilken have been found to have many disadvantages. At the present time the trend is to direct efforts toward selective surgery, the responsibility of the surgeon being to select the patient for the operation and not the operation for the patient.

Twenty years ago Finsterer suggested early operation as a treatment of choice for hemorrhage from chronic ulcer because, as he contended, such hemorrhage coming from an eroded large artery at the base of a penetrating ulcer could be stopped permanently only in this way. Foreign surgeons rapidly accepted his point of view and generally adopted surgical intervention in the treatment of bleeding ulcer. In this country, Lahey is conspicuous in joining Finsterer in the adoption of the more radical procedure, such as sub-total gastrectomy for hemorrhage, as well as for the gastric ulcer in which the question of malignancy cannot be settled, and other complications. Lahey contends it is being more and more accepted that conservative surgical procedures, such as gastroenterostomy and pyloroplasty, are no longer justifiable as routine operations for patients with gastric and duodenal ulcers. The too frequent postoperative occurrence of gastrojejunal ulcer is so resistant to medical management, has caused a great many surgeons to avoid the routine use of these conservative operations.

Acute perforation always requires surgical interference. A few small ulcers are walled off spontaneously by the omentum or a neighboring viscus. These patients may survive without operation. Naegeli *(Surgery,* November, 1938) reports a case in which a patient with acute perforated gastric ulcer of forty hours' standing was successfully treated with nasal suction. This procedure undoubtedly has value in the late cases. He calls attention to a disadvantage, that is, the depletion of Vitamin B radical through continuous emptying of the stomach. Evidence of this depletion was shown by the precipitation of a marked bradycardia and the improvement of the patient by the hypodermic introduction of Vitamin B. The mortality in cases with acute perforation is in direct relation to the length of time that has elapsed between the onset of the attack and the operation. Kelly *(Surgery,* October, 1939) comments that men are more prone to perforated ulcer than women, perforations occur more frequently during the middle years of life, the mortality increases with the age of the patient, and that the majority of perforations have antecedent histories of gastric disturbance and the physical findings are fairly constant, enabling an early diagnosis. Roentgenography is an aid in establishing the diagnosis in doubtful cases. The surgery in nearly every case need include no more than simple closure of the perforation. The procedures other than simple closure are used to cure the ulcer and such operations performed under more favorable circumstances carry a mortality in themselves. Simple closure may be done by placing sutures in normal tissue on either side of the ulcer in such a manner that constriction is avoided, and tying them together. If this method is impossible because of the size of the ulcer, it is necessary to use an omental tab to cover the perforation, holding it in there by loosely tied sutures passed through the edges of the ulcer. Constriction of the duodenum rarely occurs when this is done. In any event, it must be recognized that while the pylorus may seem to be obstructed, most of the swelling is due to edema. This simple procedure is usually all that is necessary since it must be remembered that many patients are cured by the fibrosis of the ulcer which follows perforation and suture (Lehman). Whether or not the abdominal cavity is drained apparently makes no difference. The mortality rate is practically the same. Kelly feels that spinal anesthesia is the anesthetic of choice. Pulmonary diseases constitute the largest group of complications if peritonitis is excluded.

Massive and repeated hemorrhages are a distinct indication for surgical intervention. Finsterer contends that the main purpose of operative treatment in the presence of acute gastric hemorrhage is reliable hemostasis, the question of a permanent cure of the ulcer being of secondary importance. For the purpose of hemostasis, a gastroenterostomy is made. In cases of bleeding duodenal ulcer, the same operative pro-

cedure is performed combined with ligation of the pylorus. The gastroenterostomy helps only indirectly to control the hemorrhage. The continuous emptying helps the permanent contraction of the stomach. Finsterer states that in gastric ulcer penetrating to the pancreas, it depends on the general condition of the patient whether the margins of the ulcer are simply excised and the stomach is sutured or a typical gastric resection is performed. If a duodenal ulcer penetratting into the pancreas is not resectable on account of its position and extent, he does not perform resection for exclusion of the ulcer but substitutes for it a simple ligation of the pylorus combined with a posterior gastroenterostomy. Excision of the bleeding gastric ulcer, he states, can always be performed and has a perfect hemostatic effect. If, however, the condition of the patient allows it, instead of excision he performs a typical gastric resection which guarantees a permanent cure. Lahey states that while he is entirely in sympathy with the selection of sub-total gastrectomy as a method of choice in the surgical treatment of duodenal and gastric ulcer, nevertheless he thinks that occasionally cases will arise in which it would be unsafe and unwise to apply total gastrectomy. It would be a mistake, he believes, for any one dealing with gastric and duodenal ulcer to take the attitude that all patients with gastric and duodenal ulcer, regardless of their age, condition, weight, or location of the ulcer, should be submitted to a subtotal gastrectomy. He believes that in bad risk cases it is better to perform an operation with which one is not as well satisfied but to which is attached a lower mortality rate. He states that from his experience occasionally there are patients with indurated ulcers low in the duodenum close to and even involving the common bile duct, with a marked degree of pyloric obstruction, in whom sub-total gastrectomy cannot be done with safety because of the fact that there would be insufficient duodenum left for the safe inversion of its end. Lahey states, however, that every patient with ulcer who is approached surgically should be considered as to the possibility of sub-total gastrectomy and estimated upon the basis of his general condition, age, weight, and location of the ulcer, and then only should operative procedure be selected. Allen and Welch conclude, from a study of 2,700 cases at the Massachusetts General Hospital, that one massive hemorrhage is an indication for operation in patients over 50; a single hemorrhage in the younger group demands a careful medical régimé. If the ulcer symptoms persist, or if a second massive hemorrhage occurs, operation is indicated. They state that the type of operation to be employed depends on the presence or absence of acute bleeding. Allen states that, in dealing with acute massive hemorrhage, the bleeding is controlled by the finger while all the vessels leading into the ulcer are ligated in normal tissues. If the operation is performed after the subsidence of the acute hemorrhage, a sub-total resection of the stomach should be done. If possible, the ulcer should be resected; if not, vessels supplying it should be ligated. He has found that the earlier procedure of gastroenterostomy for massive bleeding has been found to be unsatisfactory.

Pain intractable to medical treatment in ulcer, or ulcer which cannot be differentiated from cancer, is an indication for surgical treatment. Although medical treatment of peptic ulcer is much more satisfactory than it was formerly, a certain number of patients still fail to respond. Some have persistent pain despite the fact that they are supervised carefully in the hospital. Others improve in a hospital, but, owing to excessive business worries or unhappy home environments, have a recurrence of symptoms soon after leaving the hospital. Many find it difficult to continue proper medical diet and have repeated re-admissions to the hospital. This is particularly true of an ulcer situated on the posterior wall and which through protective perforation has invaded the pancreas. Hunt states that it is not the gastric ulcer, complicated by perforations, continued bleeding, or recurrent massive hemorrhage, or persistent gastric retention in which the difference of opinion exists as to what the management shall be. It is the crater lesions with none of these complications in which there is a lack of unanimity of opinion as to what the appropriate treatment shall be. The question that arises here is: is it a benign ulcer or a carcinoma? In many instances the clinical, roentgenological and gastroscopic findings in a gastric lesion leave considerable doubt as to just what the nature of the lesion may be. Even with the abdomen open and with the lesion in his hand, the surgeon of experience has felt uncertain as to whether it is benign or malignant. Often this can be determined only by the pathologist. While lesions with a crater of less than 2.5 centimeters in diameter are usually considered benign and lesions of a greater diameter are considered malignant, nevertheless there are many exceptions to this rule. The only procedure that is rational in these cases is sub-total gastrectomy, according to most surgeons. In those cases in which it is impossible because of technical difficulties, to resect the stomach, Finsterer's "resection for occlusion" may be employed (Gorgas).

There is a large group of patients with pyloric obstruction or stenosis, due to the formation of dense scar tissue, who are not favorably affected by dietary methods and to whom the administration of antispasmodics brings no relief. This condition may develop in young patients, but is much commoner in older ones. If operation cannot be avoided and there is excessive reaction around the duodenum, a conservative operation such as gastroduodenostomy may be done, in hope that a later total gastrectomy may be safely done. In these cases there is usually a low gastric acidity. Complete relief from symptoms in this group is usually gained through gastroenterostomy and, when properly performed, there is no danger of the postoperative gastrojejunal ulcer.

Trimble (*Johns Hopkins Bulletin*, 1936) states that it is unfortunate that the term "vicious circle" was introduced into the surgical vocabulary for it gives an incorrect idea of the nature of the cause of some

vomiting that occurs postoperatively. He states that the so-called vicious circle is nothing but high intestinal obstruction and concludes that this high intestinal obstruction is a change in the mesocolon, usually from edema, which produces the obstruction. Such an obstruction would not occur, he thinks, if the mesocolon is sutured high up on the stomach so that from one and a half to two inches of stomach projects into the greater peritoneal cavity. He feels that if the mesocolon is sutured close to the line of anastomosis on the small intestine such a change in the mesocolon will certainly cause obstruction. While the short loop suggested by Peterson obviates some of the causes of obstruction, nevertheless Trimble is certain that suturing of the mesocolon high on the stomach is one of the principal factors in preventing high intestinal obstruction.

In stenosis there are factors other than technical errors which may cause complications in gastroenterostomy. The patient may present himself in a condition in which immediate operation would be extremely risky. There may be acidosis, alkalosis, or hypochloremia, and the general bodily nutrition may be at a low ebb. The stomach wall is usually so stretched by over-distention with food that it is difficult to estimate the required size of the gastroenterostomy stoma. And its muscular tone is so poor that after operation peristalsis is delayed and weak, accounting for many of the poor results. The intestinal tract distal to the obstruction, having become accustomed to little if any reception of stomach contents, becomes sluggish and atonic, its secretions are diminished, and a sudden influx of food after a gastroenterostomy will usually produce symptoms popularly classified under the heading of gases, but really due to definite motor and secretory disturbances.

Before any surgery is attempted, a careful preoperative management should be employed, decompression of the stomach instituted to restore it as well as possible to its normal size. Many times this is very difficult. The advent of the nasal suction has assisted much in this procedure. Because of the jejunal ulcer and other complications following posterior gastroenterostomy, many surgeons have abandoned the posterior operation in favor of the anterior gastroenterostomy. In a discussion concerning the technical problems of gastroenterostomy, Dr. Arnold Schwyzer states that the stoma in the posterior gastroenterostomy is constantly bathed in the gastric juice when the patient is in the reclining position, which he thinks might account for ulceration at this point; while in the anterior gastroenterostomy, with the normal presence of gas in the stomach, the stoma is always free from the gastric juice when the patient is in the reclining position. He has abandoned the entero-anastomosis customarily performed in the anterior gastroenterostomy by fixing the afferent loop of the jejunum to the stomach for some distance beyond the stoma, increasing the width of the anterior Lembert suture as it advances beyond this point, thereby making the opening into the afferent loop much smaller and higher than the opening to the distal loop. Schwyzer further points out that a redundant mucosa at the stoma protects the tissues against secondary ulcer on the suture line, and, for this reason, he prefers to secure a bulky covering by pulling ample mucosa over the wound. To assist in the retention of an ample mucosa, he does not stress the careful inversion of the mucosa when the anterior half of this suture is placed. If the edges are somewhat everted, he states, the suture does not look as neat but seen from the inside there is no exposed submucosa.

When gastroenterostomy is performed on a stomach that still retains much of its dilatation, the surgeon is confronted with a difficult mechanical problem. Here, it is most important to leave the preoperatively introduced nasal catheter in place during the operation. Before the gastroenterostomy is completed, the catheter is pushed about 20 centimeters into the distal loop of the jejunum. Besides serving as a method for feeding in the dehydrated and emaciated patient, this maneuver acts as a "splint" for the anastomosis between the bowel and the stomach. This maneuver is a modification of "transgastric jejunal feeding" introduced by Dr. Arnold Schwyzer. It is a good mechanical procedure for all gastroenterostomies, but of particular value in "splinting" the anastomosis when dealing with a dilated stomach. We have made use of the pre-operative introduction of the nasal suction tube in all of our gastric surgery, leaving the catheter in position during the operation.

Summary

It is generally agreed that the indications for the surgical treatment of peptic ulcer are limited to the complications. The operative procedures employed for the treatment of complications are more carefully selected.

Gastroenterostomy is still the operation of choice in the treatment of chronic pyloric obstruction due to ulcer. The other conservative surgical procedures have little value.

The radical attack, to control massive hemorrhage from the eroded vessel in the older patient, is accepted as the better method; while the conservative management for repeated smaller hemorrhages in the younger individual, is thought to be more desirable.

Gastric resection for peptic ulcer in the selected patient, as recommended by Finsterer, is being more commonly employed.

All patients operated upon for complications of peptic ulcer should have strict postoperative supervision by a good internist.

Discussion

DR. R. R. CRANMER: Dr. Nordland has given us the indications for surgery in duodenal ulcer. Obstruction, stenosis, perforation, repeated massive hemorrhages, and patients who have received proper medical treatment over a long period of time who do not respond to that treatment, are those that should be operated upon. I think that one can add another group to that. The group that I refer to is made up of individuals, who, because of their financial status are unable to continue a long treatment; who cannot afford hospitalization, and who require more summary treatment than the medical treatment.

The percentage of duodenal ulcer cases that come to operation seems to vary in the larger clinics. Some

state that about 8 per cent of the cases they see are eventually operated. Others report as high as 40 per cent that eventually come to operation. I think Lahey operates on about 8 per cent of his cases. Now, we have all seen a variety of operations done for this over a period of years. Fifteen or twenty years ago, the operation of simple excision of the ulcer—a longtitudinal incision with transverse closure, the so-called Heineke-Mikulicz operation was done frequently, and then followed various types of pyloroplastic operations. Finney's pyloroplasty and Judd's partial pylorectomy and Horsely's pyloroplasty, which he calls a physiologic pyloroplasty, are all, of course, really gastroduodenostomies. They are, of course, used by many surgeons today. But posterior gastroenterostomy has been the operation that has been used most frequently and which probably now is more frequently done than the other operation for this condition. However, the trend today is toward a more radical operation in this class of cases. The continental surgeons have for many years done the sub-total gastrectomy for duodenal ulcer. That was not accepted in this country, nor in England, until quite recently. We did have two men here, however, who started to do that several years ago—Strauss in Chicago and Berg at Mt. Sinai, New York. They were about the only two men who used that operation for this condition, and a lot of criticism was directed toward them for using such a radical operation. I remember attending a Clinic at Michael Reiss Hospital in Chicago when Strauss was doing this operation and Lahey happened to be there. When Strauss saw Lahey, he asked him to get up and tell what he thought about the treatment of that particular case—what he would do for that case. Lahey was hesitant about getting up and saying anything, but he finally did get up and indicated in a few words that he was not yet converted to the idea of removing half of a good stomach for the cure of an ulcer in the duodenum. However, as you know now, Lahey has been converted to that idea, as he has reported very recently a large series of cases—200 done previous to a year ago. The trend then has been away from these less radical operations toward the more radical ones, the reason being, of course, that the mortality rate in good hands is less when you consider that each one of the operations that were done carried a certain mortality and very often the patient had to be operated on several times.

Lahey, in speaking about the anesthetic, said that he first used ether, but has given it up. Then he used intratracheal ethylene and has given that up. He then used spinal anesthesia (novocaine crystals) but gave that up because of the shortness of the anesthesia. However, he now is back using spinal anesthesia. He uses a very dilute solution of Nupercaine, a one to sixteen hundred solution. That produces an anesthesia of about three hours duration.

What he does is the Hoffmeister operation, which, you know, is a modification of the Billroth No. 2 operation. The connection between the jejunum and the stomach is made near the greater curvature, and the rest of the stomach closed, but the jejunum sutured to the entire stump of the stomach, in order to stabilize it and prevent it from pulling away. He removes about two-thirds or three-fourths of the stomach in this operation, and his mortality rate, previous to two and a half years ago, was about 18 per cent. His mortality rate from two and a half years ago to one and a half years ago, was about 11 per cent, and he now has operated on fifty-one consecutive cases without any mortality.

Dr. Nordland spoke about Finsterer's exclusion operation which Lahey sometimes does. Some of those cases in which it is impossible to tie off the duodenum and invert it below the pylorus, he cuts the stomach just above the pylorus and inverts the edges of the stomach. He makes certain, however, in those cases that there is not an obstruction of the duodenum, because the accumulation of the secretion manufactured by that small part of the stomach must get out; if it does not, rupture of the suture line is apt to occur.

THE SURGICAL MANAGEMENT OF CARCINOMA OF THE STOMACH*

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At the January meeting of this Society in 1936, now almost four years ago, I reviewed my experience with the surgery of carcinoma of the stomach. I propose to review tonight the cases operated upon by me for carcinoma of the stomach during the intervening years. As a prelude to this discussion, I might add that during the past year there have been some notable contributions to the surgical literature of carcinoma of the stomach. Prominent amongst these is the distinctly unusual book of Livingston and Pack entitled "End-Results in the Treatment of Gastric Cancer." This book presents a detailed statistical analysis of the incidence and results of operative treatment of cancer of the stomach. Without question, it is one of the most informative treatises ever written upon the subject. There is also the splendid treatise of Konjetzny of Hamburg "Der Magenkrebs." This monograph deals essentially with the pathological aspects of carcinoma of the stomach, especially the relationship of gastritis to the development of carcinoma. And then there are two papers, one by Ogilvie of London and the other by Parsons and Welch of Boston. Perusal of these four references will afford satisfactory orientation on the best present-day thoughts concerning the surgical management of carcinoma of the stomach.

The experience reported by me, here, in 1936 represented cases of carcinoma of the stomach observed at the University Hospital in the thirty month period between July 1, 1933, and January 1, 1936.[1] During that period 109 cases of carcinoma were observed at the hospital. Of that group forty-four were inoperable on admission because of distant metastases or a general condition which would not allow operation. Of that group of forty-four, twelve or 27 per cent were terminal on admission and died in the hospital. Resection was done in thirty-one cases or 28.4 per cent of the entire group. Thirteen of the resections were done by me, amongst which number there was one death, a mortality of 7.6 per cent.

Results in the Present Group

The present study covers the period from January 1, 1936, up to the present time and relates only to the patients operated upon by me during this interval of time. In all, fifty-five patients were operated upon by me for carcinoma of the stomach. Exploration alone was done in eight instances with no deaths; in eight instances gastroenterostomy was done with one death; gastric resection was done thirty-nine times with eight deaths—a mortality rate for the resection group of

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20.5 per cent, a distinct increase of risk as contrasted with the smaller group operated upon in the preceding thirty month interval. The incidence of resection, however, amongst the patients operated upon by me in the present group was 70.9 per cent. Undoubtedly the indications for operation were stretched in a number of cases beyond the generally accepted orthodox indications for resection, as the subtended protocols of the operative failures will indicate:

Case 1. *1/22/36—Mr. J. E., U.H. No. 644903, age seventy-four years:* Subtotal gastric resection; open anastomosis. Patient died 10 days after operation. Patient eviscerated on the fifth day. Small abscess at the site of the duodenal inversion and another at the upper end of the stoma. Evisceration undoubtedly had something, however, to do with the peritonitis.

Case 2. *4/29/36—Mrs. H. G., U.H. No. 647846, age sixty years:* Extensive gastric resection for carcinoma, excising five-sixths of the stomach. Open anastomosis. Also large incisional hernia. Patient died 10 days after operation. Small abscess at the duodenal stump. Anastomosis intact. Contributing cause of death, pneumonia. Autopsy showed some coronary sclerosis.

Case 3. *12/2/36—Mr. C. B., U.H. No. 753763, age fifty-seven years:* Carcinoma involving the distal three-fourths of the stomach; open anastomosis. Patient also had mild heart failure. Cause of death, gangrene of upper loop of jejunum due to torsion of loop. No enteroanastomosis had been made. Fatty degeneration of the liver and general peritonitis. Patient died four days after operation.

Case 4. *3/16/37—Mrs. C. P., U.H. No. 656619, age sixty-six years:* Patient with extensive carcinoma of the stomach, adherent and fused to the pancreas. Open anastomosis, excising the greater portion of the stomach. Operative injury of the mesenteric vessels due to failure to define plane of cleavage between the pancreas and the carcinoma. Patient died three days after operation and hemoperitoneum from injury of the mesenteric vessels was found. Anastomosis was intact.

Case 5. *4/29/37—Mr. J. J., U. H. No. 652204, age seventy-three years:* Extensive gastric resection, removing three-fourths of the stomach; open anastomosis. Patient could not void after operation and indwelling catheter had to be inserted. Patient died four days after operation of uremia, pulmonary edema and pneumonia. Anastomosis was intact.

Case 6. *1/5/38—Mr. M. N., U.H. No. 664896, age fifty-four years:* Excision of distal two-thirds of the stomach for a very high carcinoma. Patient developed pneumococcus type II pneumonia with bacteremia. Treated by serum. Patient died three days after operation. Anastomosis intact.

Case 7. *2/6/39—Mrs. M. G., U.H. No. 675856, age sixty-two years:* Patient had diabetes with a good deal of obstruction. Aseptic resection of the distal half of the stomach. Patient died 48 hours after operation of hypoglycemia due to administration of too much insulin. Small pulmonary embolus was found at autopsy.

Case 8. *2/24/39—Mr. E. G., U.H. No. 675913, age fifty-five years:* Story of abdominal pain for about 10 months with a 20 pound weight loss. Considerable loss of strength. No vomiting. X-ray examination showed a huge gastric defect which because of its size was interpreted as being possibly a lymphosarcoma, though the most likely diagnosis was carcinoma. It was believed to involve the entire stomach. Gastroscopy was done and the gastroscopist thought the esophagus might be involved. Because of the likelihood of the tumor being lymphosarcoma x-ray radiation was given prior to operation but without effect. A subtotal gastric resection, aseptic in type, was done without event. Enteroanastomosis was also made. Patient died of pneumonia six days after operation. There was also a pneumococcal peritonitis regarded by the pathologist as being hematogenous in nature. The suture lines were all intact. The operation lasted three hours. The pneumonia was treated by anti-pneumococcus serum.

Comment

I have little to say in justification for this increased mortality rate other than to indicate that resection has been extended to an increasingly larger number than heretofore of the patients explored for carcinoma of the stomach. The incidence of resection in the group here reported, I am embarrassed to say, exceeds the highest figure found in surgical literature by Livingston and Pack—that of Finsterer of Vienna, who resected 329 out of 518 cases (63.5 per cent). Finsterer's mortality for the group was 19.4 per cent. According to Livingston and Pack, Lahey's series of fifty resected cases among 109 operated upon constitutes the second highest reported resection rate (45.8 per cent). The mortality in Lahey's group was 34 per cent. Surgeons still have the enviable record to emulate of a 5 per cent mortality in 200 consecutive gastric resections for gastric cancer reported by Balfour. That gastric resection is a highly specialized type of surgery is well attested in Balfour's unusual accomplishment.

The oldest patient who survived resection in this group was seventy-eight years. I have previously had a patient of seventy-nine years survive resection for gastric carcinoma, and in a patient of eighty-one operated upon for gastric carcinoma the lesion turned out to be a benign ulcer! The patient survived.

There were nine patients over seventy in the present group and eighteen were more than sixty-five years of age. The youngest was forty-five years. There were three diabetics in the group. Two survived operation. One (Case 7 above) died of hypoglycemia from the administration of too much insulin. One patient of seventy-one (Mr. R. J., U.H. No. 685614), not counted in the operative mortality, after being ambulant for more than a week following operation, died of a small perforation in the gall bladder twenty-six days after operation. There have been no deaths in the last eleven resections done for gastric cancer.

One of the deaths listed above (Case 4) was a surgical blunder. However, I have since learned how one may now and then deal with the occasional case of this sort in which stomach, pancreas and carcinoma are fused into a single ill defined mass. By dividing the stomach proximal to the lesion and leaving the perforated portion of the carcinomatous posterior wall of the stomach upon the pancreas, the plane of cleavage between antrum, pylorus, duodenum and pancreas can be defined from above downward, usually without too great difficulty. With employment of traction upon cats-

paw retractors from alternate directions, the residual carcinoma can be shaved off the pancreas usually without great hazard. The defect in the pancreas is then to be repaired with placement of interrupted Halsted mattress sutures of fine silk. If the defect is too large to close satisfactorily the omentum can be sewn over it.

One of the most instructive deaths is that of Case 3, above, in which gangrene of the afferent loop of the jejunum occurred. A few similar instances reported in the surgical literature have come to the writer's notice. It is a wholly avoidable accident. Routine performance of entero-anastomosis between the afferent and efferent loops after gastric resection for carcinoma obviates its occurrence.

In another instance, that of Case 1 above, evisceration was the main surgical complication leading to a fatal outcome. Use of the left subcostal incision and closure of the wound with interrupted sutures of silk has done away essentially with this complication. No eviscerations have occurred now for a period of more than two years. At one time in this clinic, when closures were made regularly with running sutures of chromic catgut, evisceration was observed, following gastric resection for carcinoma, more commonly than following any other type of operation. In this instance and in one other, amongst the fatal cases, a small abscess was found on postmortem examination, at the site of duodenal closure.

One of the most difficult hurdles for all surgeons, in gastric resection, is acquisition of a safe method of inverting the duodenal stump. Use of a crushing clamp accompanied by over-sewing with several layers of running sutures of catgut will undoubtedly result in duodenal fistula in a number of instances, despite satisfactory inversion. For some time now, the writer has used the Petz sewing apparatus, after separating the medial wall of the duodenum adequately from the pancreas. A single row of interrupted mattress sutures of fine silk of the Halsted pattern is employed to secure duodenal inversion. Three additional sutures are placed anchoring an omental tab over the inverted duodenum.

More and more I have come to learn that pneumonia is, in part, a direct surgical complication. Commonly after a long operative procedure, the patient leaves the operating room with moist trachea and bronchi. The use of suction applied to an indwelling gastric tube prior to, during and after operation does away with the feature of aspiration. It is important, however, during and after operation, to employ the Trendelenburg position to avoid aspiration. Further, bronchoscopic aspiration of the trachea and bronchi by the anesthetist (a new function for him) directly after the completion of the operation, I have a feeling, will help materially in reducing the incidence of atelectasis and postoperative pneumonia. In the pneumonias which occur nevertheless, employment of sulphapyradine will reduce materially the incidence of mortality through this agency. In one of the cases. Case 5 above, uremia, consequent upon urinary retention, necessitating use of an indwelling catheter, was the immediate cause of death. For a period of some time now I have given patients needing indwelling urethral catheters after operations, because of urinary retention, sulphanilamide subcutaneously. Its administration serves quite effectually, apparently, to obviate pyelonephritis, oliguria and uremia, and constitutes a useful means of helping to avoid complications which spell added mortality. When the carcinoma is perforated onto the pancreas, sulphanilamide is given also subcutaneously for a few days postoperatively.

Cures

It is not so long ago, that carcinoma of the stomach was despaired of as being a hopelessly incurable disease. Perusal of Livingston and Pack's monograph on gastric cancer will suffice to convince any doubting Thomas that such is no longer the case. It is, of course, important that all stubborn opposition to operation in gastric cancer be broken down. It would appear from the review of Livingston and Pack that in the group of patients surviving resection, the ultimate cures compare favorably with other intraperitoneal malignancies such as those of the rectum and colon.

Dr. George Bergh found somewhat more than a year ago in studying the fifty-seven patients who had then survived resection for carcinoma of the stomach and were well without evidence of return of the disease: one patient well ten years after resection; one eight years; one seven and a half years; one seven years; one five and a half years; another five years; and a fairly large number under five years.

Livingston and Pack, from an intensive study of the literature of reported cases, have compounded a formula to determine the likely survival periods in the resection cases. They found that, of patients surviving resection for gastric cancer, 20 per cent will live ten years, 25 per cent will survive for five years, and 33 per cent for three years. Of those patients not accepting resections the average survival after the diagnosis is made is four months. Expressed in a formula, the short term survivors in a given series (that is, those not surviving ten years) are lumped together as twenty months. The calculation for the thirty-nine patients reported here would be as follows:

Expected survival had none been operated on—39×4 months=156 months

Shortening of life incident to operation—8 deaths × 4 months=32 months

LIVINGSTON AND PACK'S CALCULATED SURVIVAL

20% of 31 cases = 6.2 should survive 10 years
6 × 120 = 720 months
The remainder,
31 — 6 = 25 should survive on the average 20 months
25 × 20 = 500

Total 720 + 500 = 1220 months
Shortening of life by operation,
8 cases — 32
1188 months
The expected survival of the group without operation — 156
Estimated saving of life by operation in this series of patients = 1032 months — 86 years.

It is obvious, therefore, that a radical operation does afford the patient with a resectable lesion a fairly bright prospect when contrasted with his expectations without operation. It is extremely unfortunate, however, that so large a percentage of a group of gastric carcinomas are inoperable when first seen.

Diagnostic Considerations

At the University of Minnesota carcinoma of the stomach is not being diagnosed any earlier during the course of the disease than it was four years ago. In the majority of instances the delay is owing largely to the time interval which elapses before symptoms are sufficiently characteristic to direct the attention of the patient or his physician to the stomach. This is true also when the patient happens to be a physician, a surgeon or even a gastric surgeon. The x-ray is still the most important agent in the detection of the presence of carcinoma of the stomach. My associate, Dr. George S. Bergh, found in studying a series of patients operated upon for carcinoma of the stomach at this hospital that the accuracy of roentgen diagnosis on the positive side was 86.5 per cent. With reference to basal indications for operation, roentgen opinion had an accuracy of 94.2 per cent.

At the time of the previous report four years ago, a patient, Mrs. M. E., U. H. No. 645079, had just been observed, in whom the diagnosis was established on gastroscopic examination, when x-ray examination was entirely negative. In the intervening years, in only one additional patient has the diagnosis been made by gastroscopic examination when x-ray examination failed to disclose the nature of the lesion. This patient, Mr. S. D., U. H. No. 686051, at operation, proved to have a large annular polypoid carcinoma on the anterior gastric wall high up near the cardia. The crater of the carcinoma measured 9 centimeters across. Subtotal gastric resection was done without event. Dr. Cecil Watson, under whose observation the patient came, suspicioned the presence of gastric carcinoma because of blood in the stool, anemia and weight loss. Gastroscopic examination is, therefore, a useful expedient as a diagnostic procedure. Fluoroscopic and roentgen observations in the hands of an expert will, however, reveal a higher incidence of positive diagnosis. The weakness of gastroscopy lies in failure to secure material for histologic diagnosis. A fairly large number of patients with carcinoma of the stomach have free hydrochloric acid after histamine, on gastric analysis.

Pathological Considerations

It may be said that polypi are amongst the more frequent known precursors of carcinoma of the stomach. So frequently do gastric polypi become malignant that their presence constitutes a satisfactory indication for operation. Gastric polypi are associated with achlorhydria to histamine in about 90 per cent of cases. Konjetzny has stressed gastritis as an antecedent predisposing cause of gastric malignancy. Konjetzny insists that carcinoma of the stomach never develops on a normal mucous membrane. The interstitial variety of gastritis characterized by lymphocytic invasion of the stroma of the submucosa is generally recognized by pathologists. The variation in cell structure of the gastric glands is not so well understood, however. The atrophic gastric mucosa with polypoid elevations in which achlorhydria is concomitantly present, is probably a frequent precursor of gastric carcinoma. Since patients with an atrophic gastric mucosa and suffering from pernicious anemia are surviving for longer intervals, gastric carcinoma in this group is being more commonly observed. There are two such patients in this group: one in the resection series; the other in the group for which gastro-enterostomy was done.

Gastric ulcer is probably an infrequent precursor of carcinoma of the stomach. Dr. William MacCarty of Rochester reports the frequent presence of secondary cytoplasia in gastric ulcers—a finding which he has not observed in duodenal ulcers. The best available factual data,[3,4] however, suggest that carcinoma of the stomach does not develop upon a preexisting ulcer in more than 3-5 per cent of instances. The possibility of confusing gastric ulcer and carcinoma is a much more pressing question. There are instances in which a satisfactory differential can not be made by x-ray examination, observation in bed under well supervised medical management or by the surgeon at operation. In many such instances the pathologist finds it necessary to study many blocks after paraffin fixation, in order to determine satisfactorily whether the ulcer is benign or malignant.

Prinz of Kojetzny's clinic in Hamburg has described recently prepyloric defects in which the musculature is thickened in which roentgenologist, surgeon and even the pathologist have difficulty determining with definiteness whether the lesion is benign or malignant. I have seen instances of this sort. Some are undoubtedly instances of hypertrophy of the circular muscle of the pylorus of the adult. In others, however, the defect is definitely prepyloric. On section the muscle appears thickened. There may also be polypoid thickening of the mucosa overlying the muscle at this level. Prinz believes that this condition represents a precursor stage of carcinoma of the stomach. I have seen instances of this sort.*

Surgical Considerations

Preoperative Preparation.—Patients in good physical condition without obstruction and exhibiting no evidence of anemia require no special preoperative preparation. Patients with obstruction need a preoperative period of observation in which the stomach is aspirated frequently. Mild retentions respond favorably, usually, to morning and evening aspirations and ingestion of only clear liquids. We have tried frequently in instances of high grade obstructions, due to carcinoma,

*Two recent cases observed since the time of this report have exhibited findings described by Prinz. Mr. O. B., U. H. No. 671852, age 73, presented such polypoid thickening of prepyloric and antral mucosa. Mr. T. L., U. H. No. 686930, age 65, exhibited definite thickening of the prepyloric circular muscle and of the mucosa. Both conditions after histologic study were found to be benign. Gastric resection was survived without special incident in both cases.

to get a tube through the pylorus. Almost uniformly, these attempts have come to naught despite many improvisations. Such patients usually need an indwelling gastric tube to which suction is applied to forestall the occurrence of vomiting.

Far more important, however, such patients also usually have anemia, low plasma proteins and not infrequently edema. Careful pre- and postoperative administration of fluid in suitable amounts, with special reference to chloride and caloric needs and adequate hydration, are very important considerations. Such patients may be given *too little* chloride, as well as *too much*. As suggested by Paine and Armstrong, careful daily computation of the sodium chloride in the urine and in the gastric aspirations affords, in the main, a very satisfactory check.

A number of patients with low plasma protein and anemia must have a large number of transfusions of blood or serum prior to operation. If the physical status and the local lesion will permit, I prefer to operate upon such patients in one stage rather than two, knowing that more patients will be accorded the opportunity of having the complete operation.

The Operation.—The patient arrives in the operating room with an indwelling gastric tube in place and the stomach empty. Suction is in force during the operative procedure. My choice of anesthetic is intratracheal cyclopropane. A left subcostal incision affords a more satisfactory exposure of the upper reaches of the stomach than any other. For some period of time now, I have been employing the closed or aseptic technic in all gastric resections. It is a more painstaking procedure, in that all the sutures are interupted. I have the impression, however, that he who comes to adopt the aseptic method of gastric resection is not likely to give it up, because of the somewhat longer time necessary to perform it. The element of *hurry*, so much talked of in abdominal surgery two and three decades ago, has largely disappeared. With good planning and skilfully administered anesthesia the primary question now is, not *how quickly* but *how well* the operation is done.

The technic of the performance of aseptic gastric resection has been described in detail elsewhere[15] and will not be repeated here. An entero-anastomosis between the afferent and efferent limbs of the jejunum, employed in the gastro-jejunal anastomosis, is always made to avoid the complication referred to above (Case 3). It does away largely also with the item of postoperative gastric retention.

All sutures are of silk, those employed in the anastomosis, as well as in closure of the abdominal wall. A small mastisol dressing, slightly wider than the incision, suffices as a satisfactory covering of the wound. No adhesive tape or abdominal binders are employed. Closure of the peritoneum and fascia with interrupted mattress suture of silk placed after the Halsted mattress pattern has done away with the complication of evisceration.

When the peritoneum is closed, the patient is placed in a fairly steep Trendelenberg position to encourage gravitation of any bronchial mucus into the trachea. On completion of the operation, bronchoscopic aspiration of the trachea and bronchi is made by the anesthetist, or if the patient appears dry, aspiration of the trachea with a tube inserted through the indwelling intratracheal tube suffices.

I have come to prefer palliative gastric resection to gastro-enterostomy, where enough normal stomach tissue remains to make a suitable anastomosis. In frankly inoperable patients, a Pezzer catheter placed in the jejunum for purposes of feeding at the time of exploration helps the patient over the trying last few months of his illness.

Postoperative Treatment.—The patient is placed in his bed and maintained in a fairly steep Trendelenburg position till awake. The Trendelenburg position is maintained throughout the first half of the convalescent period at a lesser angle. Fowler's position is not employed. The patient is encouraged to move about in bed as much as he can after waking. Nurses and house officers enjoin upon him the importance and necessity for him "to move his arms and legs a thousand times a day." The nurse holds the patient's chest to avoid strain on, or pain in, the incision, and encourages him to take deep breaths and to give three or four coughs, a dozen or more times a day. Suction is applied to the indwelling gastric tube on return to the ward and is maintained, uninterrupted, for forty-eight to seventy-two hours, after which time it is clamped occasionally and then removed. Para-oral fluids are given largely subcutaneously to the older age group of patients, 5 per cent glucose in distilled water and 5 per cent glucose in saline solution being given, the amounts of each depending on the chloride and water requirements of the patient. The patient may drink water by mouth in small amounts as soon as he is awake.

Feeble patients past the mid-seventies, as well as debilitated patients at younger age levels are given oxygen directly after operation. If there is any suggestion of mucus in the throat which the patient cannot raise, repeated pharyngeal and intratracheal suction is practiced.

Summary

Carcinoma of the stomach is the most common of all malignancies and is responsible for more deaths than any other malignancy. Of patients presenting themselves in a satisfactory physical status and with a lesion still local in the stomach, resection may be accomplished with a reasonable risk and a reasonable chance of cure. Amongst the resectable group of gastric malignancies, cures compare favorably with other visceral malignancies, such as those of the colon or rectum. Unfortunately, a large number of patients still come to hospital with gastric cancer when the condition is beyond remedy. To make this group smaller, needs the concerted vigilant effort of patients, physicians and all medical and surgical specialists.

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DR. S. R. MAXEINER: It has been a pleasure to hear Dr. Wangensteen's discussion of gastric surgery at the University. I have been particularly interested in the work which he is doing with the aseptic anastomoses. Many of us have been using aseptic anastomoses for a number of years, particularly as applied to the colon. We have personally not applied it in resections of the stomach as we have preferred to do these resections without clamps, ligating all bleeding points as they are encountered. However, I am sure that I shall be using aseptic anastomoses more generously in the future.

Many years ago Cushing did a very extensive piece of work on the bacterial flora of the stomach and intestinal tract, and showed definitely that the bacterial flora of the stomach and intestine could be altered and the number of pyogenic organisms increased or decreased by the character of the food ingested. I believe that this is particularly applicable in cases where there is achlorhydria. Obstructive lesions with retention also favor bacterial increase. As a result, we have routinely taken at least three days to prepare our gastric cases by the use of sterilized food, the administration of hydrochloric acid and the repeated washing of the stomach with weak hydrochloric solutions. Those patients who have obstructive lesions at the pylorus are more thoroughly prepared and no residue is allowed to remain in the stomach overnight. In this manner we have avoided the use of clamps, cut down the number of postoperative hemorrhages and we believe we have also decreased the amount of postoperative peritonitis.

In a review of the literature which I did for this Society in 1935 on carcinoma of the stomach, it was interesting to note the reports of various clinics as to the increased operability of the surgically treated carcinomas of the stomach. It seems to me one must bear in mind that there are other things than cure alone to be anticipated in treatment of carcinoma of the stomach. Finsterer states, "Without resection every patient will die, and die in pain and misery. Therefore, I must resect whenever possible." The purpose of many of these resections, according to Finsterer, are therefore palliative. The observation of many surgeons of large experience revealed the fact that even palliative procedures in which the primary lesion is removed, result in prolonged recession of the metastases so that the patient often lives many years without demonstrable recurrence.

We recently performed an exclusion operation on a patient of 81 years who was suffering from severe pain from far advanced carcinoma and continued hemorrhage. He was being transfused every ten days to maintain his hemoglobin. In the exclusion operation as advocated by Balfour and which Dr. Cranmer has just stated is now being used by Lahey, the stomach was divided proximal to the growth, the distal end of the cut off stomach was inverted and the proximal cut off end was anastomosed to the jejunum. This patient has had a great deal of relief from pain. It is now nine months and although he still loses some blood in the stool he has had fewer transfusions and is able to take all types of food without retention and without pain.

I think our profession has been grossly remiss in its attitude towards carcinoma by accepting such a dubious, helpless attitude. We reported 18 resections which we realize is a comparatively small number but of these, one died at the end of five years from tuberculosis and autopsy showed that there was no recurrence at the end of this period of time. I assisted Dr. Lee seven years ago in removing a stomach cancer in an elderly woman who is still perfectly well and able to do her own work. Another patient whom I resected seven and one-half years ago remains perfectly well without symptoms of recurrence. In other words, approximately 17 per cent of the eighteen cases reported have survived five to seven and one-half years.

SURGERY OF CARCINOMA OF THE COLON

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Because it is frequently encountered, yields a relatively high percentage of cures, yet carries a high operative mortality, cancer of the large bowel continues to command the special interest of the abdominal surgeon. In no field of surgery is the operator better rewarded for the careful evaluation of all the factors bearing on his patient's condition and the judicious selection of the proper surgical procedures.

The utter impossibility of standardizing the treatment of carcinoma of the colon except as to broad principles is at once apparent when one considers the numerous procedures available, the variable factors affecting the operative risk and end result and the conflicting opinions and results recorded by able and experienced men.

As my contribution to this seminar I propose to examine some of the ideas and results of other men, to report a very limited experience of my own and generally to assist in the clarification of surgical principles which will permit the more complete individualization of treatment under any group of circumstances.

History

The evaluation of present day operative procedures with their lower mortality rate is a striking illustration of the progress of which surgery is capable.

The first successful resection was reported by Kohler in 1881. Before 1889 seventeen cases of resection had

been reported with ten deaths or a mortality of approximately 60 per cent. In the next ten years fifty-seven cases were published with 37 per cent mortality. The prevailing method was resection with end to end suture.

The two-stage operation was suggested in 1890 by Heinecke who did not himself report any cases. Oscar Block of Stockholm recorded the first case of extraperitoneal resection in 1892. Allingham, Edmunds, Hahn, Hockenegg and Rotter reported cases in the next two years. In 1895 Caird reported a successful case and in the same year Paul of Liverpool published his classical article in the British Medical Journal recording his first case treated in 1892.

Mikulicz, who did his first two-stage operation in 1898, described his exteriorization procedure in 1903, reporting sixteen cases with an operative mortality of 12.5 per cent, a rate which is creditable even today.

Only a few technical procedures have been added since. The more important are the development of aseptic technics for resection; Rankin's modification of the Paul-Mikulicz exteriorization procedure which he calls obstructive resection; and finally Devine's colostomy for the complete "defunctioning" of the distal segment containing the tumor.

Management of Obstruction

Aside from inherent factors such as the highly infectious nature of the bowel content and its uncertain and limited blood supply, those variables which operate against the success of surgery are not so much the cancer itself as the complications of the cancer. Extension of the tumor into neighboring organs, metastases, perforation with local abscess or peritonitis and most important of all, obstruction, are the obstacles to successful surgery.

Carcinoma is overwhelmingly the most common cause of obstruction of the colon. Rankin states that between 75 and 80 per cent of patients with colonic cancer have obstruction at the time they first consult a surgeon. Obstruction in the left half of the colon is eight times as common as in the right half. Burgess found evidence of acute obstructions in 35.6 per cent of 458 cases of carcinoma of the colon. Of Graham's thirty-three cases, 50 per cent were admitted with acute obstruction.

That acute obstruction of the colon is a serious condition is evidenced by a mortality rate of from 30 to 50 per cent in procedures designed only to relieve the obstruction. The work of Sperling, who demonstrated the competency of the ileocecal valve, establishes such an obstruction as of the closed loop type. A dog's colon subjected to an intraluminal pressure of from 30 to 50 cm. water will develop gangrene and necrosis of the bowel wall. Intraluminal pressures within this range were found in cases of colonic obstructions. Of twenty-six cases of acute obstruction at the Minnesota General Hospital there were nine deaths, eight of which were due to peritonitis as a result of perforation of the cecum or bowel wall proximal to the tumor.

Even incomplete obstructions are dangerous to the patient. Proximal to the obstruction the bowel wall is distended, inflamed and edematous. In this state the permeability of the bowel wall to pathogenic organisms is greatly increased predisposing to pericolonic inflamation and peritonitis, especially if the bowel is handled. In addition, stasis of contents results in a greatly increased bacterial content and increased toxicity.

As early as 1900 Körte collected fifty-eight cases of intestinal obstruction caused by colonic carcinoma with an operative mortality of 60 per cent. Exteriorization was done in eleven with 63 per cent mortality. Finster's operative mortality was 29 per cent in thirty-four cases admitted with acute obstruction and 14.7 per cent in sixty-one cases without obstruction.

There has been such unanimity of experience in dealing with obstructions that the surgical principle is firmly fixed that no direct attack on the neoplasm can be undertaken until the obstruction is relieved either by surgical or non-surgical means. In all cases of incomplete obstruction a so-called medical decompression should be attempted. This consists of a low residue diet and the oral administration of mineral oil or magnesium sulphate to liquefy the contents of the bowel. In addition oil and water or saline enemas are administered under low pressure. Successful decompression is recognized by the relief of obstructive symptoms, diminution of retained gas in the colon by x-ray and decrease in the number and volume of the liquid stools.

In acute colonic obstructions of complete or near complete degree, surgical decompression is indicated. The four procedures which may be utilized are colostomy, cecostomy, appendicostomy and ileostomy. Because of the competency of the ileocolic valve, ileostomy is of little value in decompressing an obstructed colon unless a tube be passed through the valve into the cecum. Appendicostomy has a very limited value because of the small size of the tube which can be passed through the appendiceal stoma. Neither appendicostomy or cecostomy diverts the fecal stream and is therefore less efficient than a colostomy of the permanent type with raised spur (permanent type).

Proponents of cecostomy, such as Roscoe Graham, Wilkie, Lockart-Mummery and many others, admit its limitations as a means of decompressing the colon but like it because of its simplicity. In the experience of others, Cheever, Wangensteen, Rankin, Sperling, cecostomy is either dangerous or inadequate.

Two indications for cecostomy seem logical:

1. Relief of obstructions in the ascending colon or hepatic flexure.
2. As a safety valve done coincidentally with a suture anastomosis of the bowel.

A transverse colostomy as an efficient means of decompressing the colon, is most favored. Wangensteen recommends a transverse incision through the right or left rectus. The transverse colon is brought out and held by a glass tube which is passed through the margin of the mesentery. The wound is closed around the bowel. Sutures may be inserted in the

fatty appendages but must not be inserted in the bowel wall. Gas and fluid may be aspirated or removed by a catheter held snuggly in the bowel by a purse string suture. After forty-eight hours the wound has sufficiently sealed so that the bowel wall can be opened by cautery.

An impressive amount of statistical evidence is available to show that when extirpation of the malignant growth is preceded by decompression procedures the operative mortality is reduced by one-half or even two-thirds. Cheever, Finsterer, Gordon-Watson, Roscoe Graham, Von Haberer, Allen and Paus are only a few who have so reported.

Devine with his so-called "defunctioning" type of colostomy carries to the extreme the principle of relieving obstruction in the large bowel and in so doing reduces the bacterial count to a point where relatively extensive malignancies and inflammatory lesions may be removed by open suture anastomosis and with low mortality rates.

I have had one interesting experience which has led me to believe that the full possibilities of non-surgical decompression have not been realized. An elderly man was brought to Minneapolis with complete obstruction due to a carcinoma of the sigmoid. The abdomen was grossly distended. There was no vomiting. A flat plate of the abdomen revealed enormous distention of the colon. The patient was given three to four ounces of mineral oil daily by mouth and placed on a non-residue diet with the additional support of glucose solution administered intravenously. On the seventh day, because we despaired of opening his obstruction medically, he was operated upon. The transverse colon could not be delivered because of the distention but was brought up to the abdominal wall and vaseline gauze packed into the wound ready for later opening. Later, on the day of operation he began to pass large quantities of liquid stool per rectum. Colostomy was never completed. After three weeks his tumor was resected and end to end anastomosis done over a Rankin clamp. The condition of the colon at the time of operation gave no indication that obstruction had ever been present.

This, together with other less striking experiences, has led me to believe that with sufficient time and the use of large quantities of mineral oil even high grade obstructions may be relieved by non-surgical means, thereby eliminating one stage in the operative removal of cancer of the colon.

Preparation of the Patient

While the relief of obstruction is the most important of all preoperative considerations, other measures are of great importance. Dehydration and depletion of liver glycogen should be combated by intravenous glucose solution. Anemia, so common in right sided malignancies, must be overcome by transfusions and hemopoietic stimulants.

As a result of infections associated with ulcerated processes in malignant lesions it has been shown that a marked vitamin C deficiency always occurs. Lanman, Thomas and Ingalls, Taffel and Harvey and others have shown that vitamin C deficiency interferes with wound healing. Two hundred mg. of cevitamic acid daily is sufficient to restore the deficiency. Vitamin B has a stimulating effect on appetite and on the tonicity of the large bowel. Its use is indicated preoperatively.

Efforts to increase the resistance of the peritoneal cavity to infection by the intraperitoneal injection of vaccines and various substances began in 1887 when Pawlousky used croton oil to produce peritonitis in experimental animals. Subsequent work established the protective value of exudate in peritonitis but has not established the advisability of routine vaccination. The three most commonly used immunizing agents are:

1. Steinberg's coli-bactragen.
2. Bargen's strap and coli vaccine.
3. Amoniotic fluid.

Rankin, Bargen and Dixon popularized the use of intraperitoneal vaccines. Dixon still advocates their use.

Coller and his associates believe that the routine use of vaccines is not needed or desirable but believe when spillage of infective material accidently occurs at operation the use of some substance which produces a rapid leukocytic response on the part of the peritoneum is of value. Steinberg's coli-bactragen has been most satisfactorily and extensively used by them. With this view Oschner and Allen are in complete accord.

The omnipresent sulphanilimide bids for a place in the preoperative preparation. Gailoch and Seley made cultures from the bowel wall in six carcinomas of the colon. In four, streptococcus hemoliticus in conjunction with bacillus coli were recovered. In twenty-one cases in which the blood sulphanilimide level was maintained at 5 to 6 mg. per cent for three days prior to operation streptococci, were not obtained and no peritonitis occurred.

Choice of Operation

Considerable disagreement is evidenced among surgeons of equivalent experience as to what constitutes the safest and most effective procedures. That technical considerations are important is suggested by the very considerable difference in results shown by different men with the same methods and under presumably similar conditions.

For example, Lahey advocates an exteriorizing operation in surgery of the right half of the colon. In his hands the procedure is safe and effective. Others who have tried it condemn it because of a high mortality rate. Cheever gets better results with open suture anastomosis. Rankin and others condemn it.

In the right half of the colon where feces are fluid, obstruction rare, blood supply scanty and lymphatics plentiful, the surgeon must choose between Lahey's exteriorizing operation, hemi-resection of the colon with ileocolostomy either as a preliminary or as coincidental procedure and resection with suture anastomosis either by aseptic or open technics.

In the transverse colon the surgeon must choose between an exteriorization procedure of which Rankin's

obstructive resection is most favored, or resection with end to end or side to side anastomosis. He must also decide whether a preliminary or coincidental cecostomy or colostomy is to be done.

In the sigmoid and recto-sigmoid the choice rests between obstructive resection and resection with end to end anastomosis. He must decide whether a preliminary colostomy is needed and whether of the ordinary spur type or of the Devine "defunctioning" type. When the lesion is low, the question is raised whether the rectum can be saved and if so whether restoration of continuity can be accomplished at the same or later time.

If one seeks the answer to these questions in the experience of others, considerable confusion arises. While there is fairly uniform agreement on the broad principles involved there is much difference of opinion in their application.

A surgeon may produce extremely favorable statistics as an argument for his particular procedure if he considers as inoperable all tumors showing adhesions to surrounding the organs or showing lymphnode enlargements. Unless he realizes that both adhesions and lymphadenopathies may be inflammatory and not malignant he is denying the right of cure or palliation to a considerable number of patients. In a series of twenty-six articles an operability of over 50 per cent is reported in two-thirds and slightly under 50 per cent in the remaining third.

In a series of 2,991 cases collected by Ochsner the mortality was 21.7 per cent. The lowest was 3.1 per cent in a series of thirty-two cases and the highest was 63 per cent of twenty-seven cases. Of 3,911 resections 30.7 per cent were alive and well five years. The highest incidence of five-year cures was obtained by Oughterson and Shelton: 52.6 per cent of a series of 131 cases.

There are few statistics to indicate the advantage of an aseptic anastomosis over open suture but those available show a small advantage in favor of aseptic methods. McFee reports a 16.1 per cent operative mortality in fifty-six cases where aseptic anastomosis was done and 18.8 per cent of thirty-two cases in which open anastomosis was done. Allen and Welch report 11 per cent operative mortality in fifty-two cases using the Parker-Kerr aseptic technic and 23 per cent of thirty-eight in open anastomosis. The same authors show 22 per cent mortality in eighteen cases in which clamps were used to effect aseptic suture. Stone and McLanahan show an operative mortality rate of 11.2 per cent for seventy-one cases in which aseptic anastomosis was done while in nineteen cases of open anastomosis there was a 26.3 per cent mortality.

Until recently it was the concensus that right sided lesions could be safely resected in one stage. Recently Allen, Rankin, Abell, Cheever, Paus, Guy Turner, Dixon have produced figures indicating that the operative mortality is distinctly less when preliminary ileocolostomy is done. Lahey's exteriorization operation for right sided lesions, while successful in his hands, has not received general acceptance. At the University of Minnesota it has been abandoned because of a prohibitive mortality. It has the disadvantage that the greater procedure comes first and in cases of obstruction or inflamation, it does not provide for a preliminary diversion of the fecal stream.

The exponents of the single stage suture anastomosis are comparatively few. Wilkie and Lockhart Mummery favor it. Cheever and C. W. Mayo recommend resection and end to end suture in the transverse colon. The former reports an 18 per cent mortality in eleven operations and the latter 11 per cent in thirty-six cases. In ninety-five cases where obstructive resection was done on the transverse colon, C. W. Mayo had a 20 per cent mortality rate. He concluded that end to end aseptic suture in the transverse colon is a safer procedure than exteriorization. The average hospital stay in the former was twenty days and in the latter fifty-nine days. Stone and McLanahan report seventy-one cases of aseptic end to end anastomosis with 11.2 per cent mortality.

After a preliminary decompression there is a greater readiness to resect and to do a primary anastomosis. Allen and Welch record their lowest mortality rate when end to end suture is done. Devine, after he has "defunctioned" the bowel for a month, removes the cancer and either does an immediate end to end suture or more often implants the end of the bowel in the abdominal wall, waits a longer time before establishing continuity of the bowel.

In low carcinomas of the sigmoid or high recto-sigmoid malignancies, where exteriorization is difficult or impossible and where the resection of the tumor destroys the superior hemorrhoidal artery, Devine's method of closing the rectum and suturing the lower end of the sigmoid in the wound makes it possible to save the anal sphincter. Dixon utilizes a procedure of a similar nature using one less stage, in that the resection and anastomosis are accomplished at the same time. In his experience the middle hemorrhoidal arteries have always proven adequate to maintain the viability of the rectum.

The feeling is definitely against end to end suture in the descending colon and sigmoid. Even in the transverse and proximal colon the few advocates recommend either a preliminary or coincidental cecostomy or colostomy. Yet in thirty successful cases of suture anastomosis in the transverse and left colon Cheever reports eight who had no preliminary or simultaneous colostomy. None developed leaks.

He apologizes for his temerity with the statement, "This again illustrates how misleading statistics may be, for certainly no surgeon of experience would advise primary resection with suture anastomosis without making a proximal safety valve."

Although the series is small, I wish to report my limited experience with twelve carcinomas of the colon treated by one stage resection and end to end anastomosis without preliminary or simultaneous colostomy or cecostomy. Nine of the eleven cases were in the sigmoid and descending colon, one was in the splenic flexure, one in the transverse and one in the ascending colon. There was one operative death. This man developed pneumonia late in his convalescence.

At autopsy the suture line was solid and the peritoneum clean.

These cases were all ideal for any type of operation. In only one, as recently described, was there high grade obstruction and in this case non-operative means removed every residual of obstruction within three weeks. All received mineral oil by mouth, were kept on a non-residue diet for three to five days and given daily enemas.

The anastomosis was done over a Rankin clamp. In earlier cases two rows of continuous cat gut suture were used. Later the first row only was of cat gut, the outer row of silk. In every case fatty tags and omentum were utilized to cover the suture line.

Post-operatively the patient was maintained on 2,000 c.c. 10 per cent glucose solution daily given intravenously. Nasal suction was started immediately and mineral oil on the second or third day. A rectal tube was inserted for alternate hours after the first day. Most patients passed liquid stool about the fourth or fifth day. Convalescence was remarkably uneventful. In no case was there more than slight distention. There was one wound infection, no fecal fistula.

The cases are too recent to determine the outcome. One woman had a Krukenberg tumor at the time of resection and subsequently died of cancer. One man developed a recurrence near the site of resection and was successfully reoperated with the establishment of a permanent colostomy. It is probable that he will develop other metastases.

The technic is exacting and time consuming. Meticulous care is needed to preserve the blood supply. The clamps should be applied obliquely to protect the viability of the suture line at its anti-mesenteric border. It is advisable to test the effect of obstructing every major blood vessel before it is permanently crushed. On one occasion an intended local resection of malignancy of the ascending colon had to be converted to a resection of the right half of the colon because what appeared to be a minor artery, when ligated, cut off the supply to the entire cecum.

None of these cases was operated with the predetermined object of doing this type of anastomosis. Had there been any evidence of obstruction or inflamation, obstructive resection would have been done. They were so operated because they were ideal cases and because the premise was entertained that under ideal conditions and using an aseptic technic for anastomosis there should be no additional hazard to the one stage operation. By withholding food and by giving relatively large quantities of mineral oil the contents of the left half of the colon may be kept fluid enough to pass through the stoma of the anastomosis. The rectal tube sufficed for the relief of gas, although had gross distention occurred, cecostomy could have been done.

The graded type of operation has proven its safety and effectiveness. No principle in colon surgery has been more completely established and accepted. Nevertheless, there are cases in which multiple stage procedures seem unnecessary and advantage may be taken of the savings in time, expense and discomfort which the single stage operation affords.

Twelve cases is too small a series from which to draw any conclusions. Many men of far wider experience have condemned the one stage procedure on the left colon. For the present I shall persist in my belief that under ideal conditions the single stage resection with aseptic anastomosis is a reasonable and relatively safe procedure and that by using large quantities of mineral oil, low residue diets and plenty of time patients with relatively high grade obstructions may be completely decompressed and saved the necessity of a preliminary colostomy.

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Discussion

DR. E. A. REGNIER: I think Dr. Campbell has had a unique experience in his success with eleven colon resections with primary anastomoses. I will frankly admit that my experience is much more limited. Surgery of the colon is so often complicated by either obstruction, inflammation or perforation that I have chosen the more conservative operation, namely, the modified Mikulicz operation. This operation lends itself to more lesions of the large bowel than any other one operation that I know of and with a greater degree of safety. I was impressed early in medicine by the danger of doing an anastomosis of the colon without a previous decompression operation. By thoroughly mobilizing the colon and by staggering the proximal or distal loop, extensive resections may be done in any portion of the colon, permitting exteriorization of the contaminated bowel. Obviously, as Dr. Campbell has shown, the ideal case may be safely resected and anastomosed in one stage. I believe no discussion of surgery of the colon should be closed without calling attention to the lack of early diagnosis of these lesions, thereby raising the percentage of curable cases.

Lahey has shown that 75 per cent of all carcinomas of the colon occur between the splenic flexure and the anus. He has also shown that 65 per cent of the polyps and pedunculated adenomas occur in this same position of the bowel, hence the close correlation between these so-called innocent lesions in the occurrence of carcinoma. The early findings and removal of these lesions would probably prevent many carcinomas or would certainly lead to early diagnosis. All authors agree that 95 per cent of people with lesions of the colon have an antecedent of marked alteration in bowel habit. I believe that earlier diagnoses of malignant lesions of the colon and bringing these people to operation at a time when the lesions are purely local would raise the percentage of operability and would probably select lesions which could be removed by less complicated procedures.

ADVERSE SOCIAL FACTORS

Adverse social factors have significance in medical care chiefly because of their power to disable. Deprivations, strains and dissatisfactions have physiological effects such as depletion of bodily substance, fatigue and emotional tension which are of special importance in aggravating disability already started by organic disease. Medical care can be more economical when discovery and control of adverse social factors is instituted. This is more important in the case of chronic disease such as tuberculosis.—Social Component in Medical Care, THORNTON, J., Columbia Univ. Press, 1938.

ANTHRACO-SILICOSIS

Statistics from White Haven Sanatorium, Pennsylvania, reveal that tuberculosis of the intestine was found in only 19 per cent of the cases where anthraco-silicosis and pulmonary tuberculosis were associated as contrasted to 51 per cent where the pulmonary tuberculosis was uncomplicated by silicosis. This may be due to the extreme fibrosis present in these cases preventing the spread of the tubercle bacilli. In early or moderately advanced cases of silicosis the rate of intestinal involvement is the same as in the cases which do not have silicosis.—CHARR, R., and COHEN, A. C., Am. Jour. Med. Science, 1938, 196.

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*"Treatment of Acute Anterior Urethritis with Silver Picrate," Knight and Shelanski, AMERICAN JOURNAL OF SYPHILIS, GONORRHEA AND VENEREAL DISEASES, Vol. 23, No. 2, pages 201-206, March, 1939.

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